REASON AND NECESSITY

Essays on Plato's *Timaeus*

edited by

M.R. Wright

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13 OCT 2006

Contributors:

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PREFACE

This collection of essays derives initially from a conference on Plato's *Timaeus* and related works, held in Lampeter in August 1998, with support from the University of Wales Institute of Classics and Ancient History (UWICAH). Four of the papers given then (by Burgess, Campbell, Opsomer and Zedda) are incorporated into the subsequent publication, with additional original contributions from Barker, Dean-Jones, Gill and Wright. The editors were to have been Burgess and Zedda, but circumstances obliged them to withdraw. The initiative of these two bright young scholars in organizing the conference and making the first moves towards the subsequent publication is gratefully acknowledged, along with the continuing encouragement and editorial expertise of Anton Powell, Director of UWICAH.

M.R.W.
Lampeter,
2000

INTRODUCTION

M.R. Wright

'One, two, three – but where, dear Timaeus, is the fourth?' This deceptively simple opening introduces one of the most complex mathematical and scientific works to survive from antiquity. In this dialogue the character Socrates, in the company of Timaeus, Critias and Hermocrates, recapitulates the main features of the political reforms he had set out the previous day (i.e. books 1–5 of the *Republic*, excluding the philosopher-kings and their education); he looks for similar (philosophical) entertainment in return, in particular some account of his ideal citizens in action. Critias obliges with a summary of the story of Atlantis, involving events that happened nine thousand years ago; this was told to Solon by the Egyptians and passed down through the generations of Critias' family. The noble citizens in action are the Athenians of long ago, who halted the forces of the mighty city of Atlantis as they attempted to extend their empire over all the Mediterranean lands. Then in a single day Athens was reported to have been destroyed in an earthquake, and Atlantis completely flooded by the sea. Critias promises to tell the story in more detail (a promise partially fulfilled in the incomplete dialogue named after him), but before that Timaeus, the most astronomical in the company (ὁ ἀστρονομικώτατος ἡμῶν) and an expert in such matters, will entertain Socrates with a narrative that starts with the generation of the cosmos and ends with an account of human nature. Timaeus begins by making the common Platonic distinction (and one that had featured in books 5 to 7 of the *Republic*) between eternal, changeless independent *being* apprehended by reason, and contingent shifting *becoming*, the object of opinion. An account is of the same character as its content, so a *logos* of the unchanging will be stable and irrefutable whereas a *muthos* ('myth') of a likeness of the unchanging will itself be unstable, no more than 'likely' or 'probable'.

The close links with the *Republic* and then the advance warning on the dubious epistemological status of myth and the ontology of its subject matter are deliberate guidelines set down for the interpretation of Timaeus' narrative. So it is appropriate to begin this collection of essays with an attempt to interpret these guidelines in the general context of the traditional contrast between truth and myth and in Plato's own treatment

of myth in different dialogues. This is Wright's aim in the first contribution as she explores the connections between myth, science and reason in Platonic theory, and the implications for the assessment, in Plato's eyes, of mathematical practices and scientific achievements.

The construction of the world, according to Timaeus, comes about through a combination of reason and necessity, but reason is the dominant partner. Reason (*nous*, a masculine noun) persuades necessity (*anagkē*, feminine) to work for the best, and so brings order out of disorder:

> The composite genesis of this cosmos arose from the union of necessity and reason; since reason controls necessity by persuading it to bring most of what is being generated to the best result, in this way, because of this and through the subjugation of necessity by intelligent persuasion, there began the construction of this whole universe.[1]

The narrative therefore falls into three sections: (i) the explanation of the role of reason, (ii) the interpretation of necessity as the 'receptacle' (ἡ ὑποδοχή), like a nurse or mother of generation, and (iii) the focus on human structures as particular results of reason working with necessity.

Reason is instantiated in the divine craftsman or demiurge (ὁ δημιουργος). The title *dēmiourgos* means literally a 'workman of the people'; surprisingly perhaps, the aristocratic Plato uses the lowliest artisan – potter, metal-worker, cobbler – as the model for this supreme god.[2] The universe is therefore viewed as an artefact constructed by a skilled craftsman from formless material, but, since the demiurge is god, and supremely good, he aims to make his artefact good like himself. So, through his providence (πρόνοια), he puts reason in soul and soul in body to produce the finest and best possible natural construction, resulting, according to this plausible account (κατὰ λόγον τὸν εἰκότα), in an ensouled intelligent living creature (ζῷον ἔμψυχον ἔννουν).

The body of the world is then briefly described. It is made of the four Empedoclean elements with water and air between fire and earth in proportion to give a three-dimensional structure, formed into a sphere and set to rotate uniformly on its axis. The soul of the world is superior to its body but the exigencies of the narrative have put its construction later. Timaeus' account of the construction of the world soul is extremely complex. Here the demiurge needs all the skill of a master metalworker to fashion it, and it is in this context that Zedda's essay 'How to build a world soul – a practical guide' is indispensable. Zedda takes us through the complexities of the construction, involving the operations of blending, hammering, marking according to harmonic proportions, cutting and shaping the strips, and then the insertion of this structure into the world

body to give the proportionate movements of the planets. Zedda plausibly suggests that the description of what is in effect an armillary sphere itself acts as an intermediate term between objects of becoming and the model that the demiurge has in mind as his inspiration.

With the world soul fitted right through the world body time itself, a 'moving image of eternity' (εἰκὼν κινητός τις αἰῶνος), is measured by the orbits of the sun, moon and planets. In the continuation of Timaeus' narrative, the next stage is the introduction of living creatures into the structure to complete it. First the demiurge produces two kinds of lesser gods – the bright and beautiful fiery stars that make up the 'embroidery' of the sky and the traditional gods known from Hesiod – and hands over to them the construction of the bodies of mortal creatures. He himself had made their souls from the residue of the world soul mixture, and had sown some in the stars (from which they would descend to live on earth) and some in the moon and other planets. If he were to fashion the bodies for these creatures they would be equal to gods, but, since they are to be a combination of mortal and immortal, he entrusts the task to the lesser gods. These then, using minute 'rivets' (γόμφοι), construct the bodies from earth, air, fire and water, and insert into them the orbits of immortal soul.

The shape of the human body is described in teleological terms, according to the guiding principle that all must be for the best. The head is made spherical to contain the orbits of the soul in imitation of the pattern of the cosmos; the body keeps the head raised from the ground and prevents it rolling around; the arms and legs provide movement and support; the face looks forward, with the eyes designed to contemplate the revolutions of the heavens, and the ears to listen to harmonies. But Timaeus leaves the details of the functioning of sense-perception to the end of the second main section of the narrative, and human physiology and psychology are treated in the third section, when he tells of the lesser gods constructing bodily parts and organs around a tripartite soul in the *minutiae* of their task. It is convenient therefore, in dealing with the human body, to takes these passages together and relate to them the three essays dealing with the human body – those of Burgess, Gill and Barker.

There are no early Hippocratic texts on anatomy, and Aristotle, coming after Plato, admits that the internal parts of the body were not well known. Their structure and function mainly seem to have been understood from the external signs, and from war wounds and other injuries. Human dissection was almost certainly taboo, but some information would have been derived by analogy with animals, in particular in the context of animal sacrifice and the jointing and distributing of meat. An early

physician-philosopher like Alcmaeon of Croton may have derived his theories about the connection of the brain with sensory passages in eye, ear and nose from such sources. Plato ostensibly sets out, in the *Timaeus*, to give an account of the human frame, the bodily organs and tissues, perception and the mechanisms of digestion and respiration. But the details come in the account of the work of the lesser gods as they attempt to harmonize reason and necessity within a comprehensive teleology, and this programme overrides any interest in anatomical precision. The priorities are well brought out in the different approaches to the topic found in these three essays.

The idealist's guide to building a human body in Burgess' contribution focuses on the sinews 'in order to see Plato's biology as an integral part of the cosmic system'. Although the distinction between muscle and sinew was available to Plato he used a single term *neura* which allowed him to set up the main structure of the body as a triadic formation. Sinews are an intermediate blend of the two extremes of bone and flesh, acting as a mid-term between them, and this reflects the blended nature of both world soul and human soul, each 'in the middle' between the indivisible and divisible, the enduring and the temporary. And human soul in turn is proportionate to world soul and human body, the crucial link between the two. The harmony of the whole cosmic design, from the grandeur of the heavenly revolutions of world soul to the fragility of human flesh, is thus secure.

How then are obvious failures to be explained? The reasoning faculty of the human soul often fails, physical and psychic diseases are rampant, and the goodness of the divine demiurge is challenged by human wrongdoing. Gill's essay tackles Plato on the great Problem of Evil by concentrating on its most obvious manifestation, moral evil, and exploring its interpretation as a consequence of psychic illness. The final part of Timaeus' narrative, after the account of human soul and human body, discusses the phenomena of their 'diseased' condition. Diseases of the mind appear as madness and ignorance, and these are closely linked as aspects of psychic illness with a physiological cause. Plato's focus, as Gill explains, seems to be on producing a comprehensive explanation of the whole range of psychological defects as forms of illness. The immediate and apparently astonishing consequence of this theory is that people should not be blamed or held responsible for their wrongdoing since it is attributable to some physical defect affecting the *psychē*. The implications may be assimilated to Platonic thought elsewhere concerning wrongdoing as 'ignorance' or 'disorder', to be treated by education and dialectic rather than punished in a traditional sense. But Gill also suggests that the text of the *Timaeus* here can be

illuminated by reference to Galen on the body-*psychē* relationship and to Stoic ideas of psychic illness as disruption of the harmonious structure of the body. We could add that the Stoic emphasis on the right tension (*tonos*) of the soul for psychic well-being also has its counterpart in the *Timaeus* in the need for the correct tension of sinews, as explained by Burgess, for optimum physical health.

Music is a key issue in psycho-physical therapy and, as Barker shows, links the organ of hearing via the brain to the lower part of the soul in the liver. From there a response is returned to the rational soul where it can be interpreted within the framework of the divine harmonics of the world soul. The human soul is then able to improve its imitation (*mimēsis*) of the cosmic order, correct defects in itself (which might lead to the madness and ignorance that Gill discusses) and programme the body to restore and maintain its own harmony. Barker tracks this pattern through the brief and sometimes ambiguous exposition given in the narrative, complemented by some very convincing speculation. The phenomenon of hearing a sound starts with movement in the outside air, which causes an impulse to enter the ear and make an impact on the reasoning part of the soul located in the head. The impact is immediately transmitted to the lower part of the soul concerned with perception, which is located in the liver. The liver apparently then translates the movements that make up hearing into patterns (according to the relative speeds) of concordant and discordant sounds; these patterns are reflected on its smooth surface as images and so returned from the lower to the upper part of the soul. Liver images that are harmonious bring pleasant days and peaceful nights, but when they are subject to rational analysis the enjoyment is enhanced by the appreciation of them in terms of the science of mathematical harmonics; in this way the human soul has the opportunity to approach and imitate the divine. As psychic illness has been interpreted in the *Timaeus* as the 'body's fault', so, in this theory of aesthetics, rhythm and melody could be therapeutic as well as enjoyable for both body and soul.

The main character in Timaeus' cosmology myth is the divine demiurge, who imposes form on shapeless material, constructing an artefact in the manner of a human craftsman, whether a potter working with clay, a sculptor with marble or a metal-worker with alloys. The craftsman has a paradigm, in his head or as a sketch or model, and aims to reproduce this in his material, but to some extent the material is recalcitrant so that the resulting product, whether pot or statue or shield, is never perfect, but the best possible. The formless material in which the demiurge sets out to reproduce his model is called 'necessity', not here a universal principle ordaining what is to be (the sense it bears in Plato's Myth of Er)[3] but quite

the opposite. It is disorderly and irregular, characterless but 'receiving everything' (πανδεχές, 51a), comparable to what Samuel Alexander called 'the restlessness of space-time'.[4] This receptacle (ὑποδοχή) is 'persuaded' by reason (exemplified by the demiurge) to receive the geometric forms which will be the basis of the four elemental solids (fire-pyramid, air-octahedron, water-icosahedron and earth-cube) from which the cosmos, like a craftsman's artefact, will be constructed as a close but never exact copy of its model.

From another aspect the three entities *being* (ὄν), *space* (χώρα) and *becoming* (γένεσις) can be seen as a triad of *father* (the eternal paradigm), *mother* (the receptacle) and *child* (the perceptible cosmos). This is the focal point of Dean-Jones' essay as she elucidates Plato's meaning here, compares it with the work of Aristotle on generation from form and prime matter, and explores its significance for Aristotle's theory of family resemblance. In her careful analysis of the relevant texts on sexual reproduction she finds a way in which the *Timaeus* can illuminate the conundrum of how, according to Aristotle, a child might resemble its mother, and allows the mother a role in determining some of the characteristics of her child.

The influence of the *Timaeus* extended beyond Aristotle into Hellenistic philosophy and it eventually became a key text for Neoplatonism, due in no small part to Proclus' commentary on it. In this context Opsomer studies the role of demiurgy as a means of illuminating the complex hierarchical structure of Neoplatonic reality and the problem of making the causal transition from the unmoved One to the perpetual motion of the physical world. The distinction between being and becoming, rest and motion, the eternal and the transitory is clear enough throughout the *Timaeus*, but the activities of the eternal demiurge and those of the lesser gods who carry out his purpose allow both a unity to the whole and a ranking within it of a range of causes. But the demiurge himself is a mediator in that he transmits the powers of the higher realm, consisting, after the One, in Being, Life and Intellect, to the lower as 'intellective intellect'. Opsomer takes us through Proclus' interpretation of these levels and then focuses on the status of the lesser 'encosmic' gods as between immortal and mortal, eternity and time, having a beginning but then perpetually being regenerated. Mortals therefore receive their unity, being and form from the first demiurgic activity but their multiplicity, individuality and generation from the secondary. Problems remain, but the relevance and importance of Plato's *Timaeus* to the interpretation of Neoplatonic procession is firmly established.

In a broader sweep of the history of ideas Campbell explores the *Timaeus* in the context of theories of zoogony and evolution stretching from the

Presocratics to Darwin and Lamarck. Campbell starts from Lucretius book 5, since this contains early anti-teleological ideas going back to the Presocratic Democritus to which Plato was obviously replying. In this scheme all possible animals came into being at the same time in the beginning; some that were viable bred and continued their line, whereas others died out. Then, in a second round of extinctions, whole species disappeared where there were no individual or co-operative strengths to enable them to survive in a competitive environment. Empedocles, as far as can be gleaned from the evidence, held a similar non-evolutionary theory, one in which maladapted forms passed away because they were made of a non-viable (chance) combination of parts. Anaximander earlier may have believed that originally humans were linked to or protected by fish in some way, and this is consistent with anthropogenic myths of human origins from earth or earth and water. So the general picture facing Plato was of more or less mechanistic developments, with humans emerging from an earlier state that was akin to, but not to be identified with, other animal forms. In principle Campbell finds that Plato reverses this programme in the *Timaeus*: humans are created first, and then animal species are generated from humans by a series of degradations from the human form which are brought about through behavioural defects. By processes of metamorphosis and metempsychosis, more akin to myth than scientific theory, humans are said to change into birds or animals, and then some animals into fish. Plato may have subverted earlier scientific cosmogony and zoogony for his own teleological purposes, which in turn yielded over the centuries to Darwin's continuation of the mechanistic tradition in his *Origin of Species*, but the *Timaeus* retains its relevance, and is currently being reinstated in contemporary theories of 'Scientific Creationism'.

Notes

1 *Tim.* 48a: μεμειγμένη ἡ τοῦδε τοῦ κόσμου γένεσις ἐξ ἀνάγκης τε καὶ νοῦ συστάσεως ἐγεννήθη· νοῦ δὲ ἀνάγκης ἄρχοντος τῷ πείθειν αὐτὴν τῶν γιγνομένων τὰ πλεῖστα ἐπὶ τὸ βέλτιστον ἄγειν, ταύτῃ κατὰ ταῦτά τε δι᾽ ἀνάγκης ἡττωμένης ὑπὸ πειθοῦς ἔμφρονος οὕτω κατ᾽ ἀρχὰς συνίστατο τόδε τὸ πᾶν. The present participles ἄρχοντος and γιγνομένων and the imperfect συνίστατο shows that the process is continuous.

2 Alternatives used are *maker* (ὁ ποιῶν, ὁ ποιητής), *fitter* (ὁ τεκταινόμενος), *constructor* (ὁ συνίστας) as well as simply *god* or *father*.

3 Cf. *Rep.* 617b–d, where Necessity is personified as the mother of the Fates and holds in her lap a model of the cosmos.

4 Cf. S. Alexander, 1920, *Space, Time and Deity*, London, *passim*.

OUTLINE OF TOPICS IN PLATO'S *TIMAEUS*

17–19 Summary of *Republic* book 2 (369b) to book 5 (456e)
20–26 Myth of Atlantis

The Cosmology Myth: Reason
27–29 the myth belongs with probability and becoming
30–34 the world body, constructed by the demiurge from the four elements
35–39 the world soul and its ordered movements
40–41 the lesser gods and their task
42–44 human soul and its disordered movements; possible reincarnations
44–47 human body containing human soul: head, limbs, eyes and ears

The Cosmology Myth: Necessity
48–50 the Receptacle as formless space, 'shaking' disordered traces of the four elements
51–52 *space* now added as a third to *being* and *becoming* (shown to be distinct with a proof from forms)
53–55 triangles, as elements of elements, impose mathematical order in space
56–63 the construction of earth, air, fire and water into regular three-dimensional solids, and their transformations
64–68 physical sensations: touch, taste, smell, hearing, sight; pleasure and pain

The Cosmology Myth: Reason and Necessity together
69–76 physiological details of the union of human soul and body: heart, lung, belly, liver, marrow, bone, flesh, sinews; structure of the head
77–80 plants as food; veins and air passages; respiration; movement without void; projectiles and sounds; digestion
81–87 death and decay; physical and psychic illnesses
87–90 physical fitness and psychic well-being; harmony within the individual and affinity with the cosmos

Endnotes
91–92 on women, sexual reproduction, birds, animals, reptiles and fish

Conclusion
92 the cosmos as perceptible god in the image of the intelligible: grand, good, most beautiful, unique and complete

The left-hand numbers refer to the pages of the Stephanus edition (1578), the traditional method of reference for works of Plato.

1

MYTH, SCIENCE AND REASON IN THE *TIMAEUS*

M.R. Wright

In Platonic theory science is myth, and an investigation into the structure and functioning of the natural world is to be classified as *mythologia*, 'myth-making'. To the modern reader such an assumption seems extraordinary, for the two concepts appear to be incompatible, even contradictory. Myth is taken to belong with narrative and imaginative fiction, appealing to emotion, suitable for children and the less intelligent, capable of numerous versions and adaptations, slippery and above all unreliable and unverifiable. Science on the other hand is associated with reasoned argument and the conceptual, practised by the brightest minds; it deals with evidence and proof; the results are demonstrably verifiable; and here surely is where truth is to be found, and the confident expansion of the *corpus* of human knowledge.

This essay sets out to tackle a number of problems related to Plato's assessment of his great scientific achievement in the *Timaeus*, with its account of some of the latest developments in cosmology, astronomy, mathematics, medicine, human biology, metallurgy and chemistry, as a kind of story-telling, a relaxation from the hard toil of dialectic and metaphysics. I first look at Plato's use of myth as an educational tool, coupled with his rejection of the traditional mythology of epic and tragedy, and his disparaging treatment of other philosophies as mythologizing, and I set this attitude against his own myth-making in the areas of prehistory and eschatology. On this basis, and given the close connections of *Phaedo*, *Phaedrus* and *Republic* with the *Timaeus*, light may be shed both on the ontological status of the subject of science as belonging to the sphere of change and 'becoming', and the epistemological ranking of scientific study as opinion or belief (*doxa*), which deals with guesses and uncertainties, where myth-making thrives. Furthermore, Plato's concern with introducing providence into the study of nature in his ongoing struggle with atheistic cosmic models requires the *narrative* of a divine craftsman constructing an artefact, who has the

best of reasons for the placing and function of all its parts. According to the metaphysics of the related dialogues, this artefact will be an image or copy of an eternal perfect model, and so the narration of it is likewise an 'imaging', a fiction guessing at the truth. In this guise natural science is recreational, but also 'serious play' in that the intellectual effort involved, especially in the grasp of the mathematical details, is excellent training for the practice of mature philosophy.

I. The educational value of traditional myth

The dichotomy between fact and fiction in an account of gods, nature and humans goes back to Hesiod. In the prologue to the *Theogony* the poet attributes his inspiration to the Muses, whom he describes as appearing to him on Mount Helicon, and offering him gifts: the staff which assures his authority as minstrel, the breath of divine voice and the subject for his poem. The resulting account of the emergence of the world and the settlement within it of divine, human and natural features will be a combination of lies and truth, for, as the Muses say, 'we know how to relate many false things that resemble what is real, but, when we wish, to tell the truth'.[1]

This assessment of the myth of Hesiod's *Theogony*, as a narrative of lies like the truth yet including an element of the true, reappears at the beginning of Plato's account of the education syllabus in the second book of the *Republic*. In the context of the suitability of myths for children, Socrates as expositor claims that there are two forms of *logoi*, the true and the false; children have to be educated in both, but first in the false. When Adeimantus admits that he does not understand, Socrates explains that at first children are brought up on myths. In the pre-school education of infants we use stories in which a false account is given, but with some truth in it;[2] mothers and nurses aim to use the καλὸς μῦθος (the noble type of myth in which truth prevails) to mould the souls of their charges. The assumption that it is obvious that babies take in myths about gods with their mothers' milk, and in this way are brought up on orthodox theology, persists through to the *Laws*: 'these myths,' says the Athenian spokesman there, 'are recited like mantras, part playful and part serious, and children love hearing them, and watching the ceremonial re-enactments of them'.[3] The contrast with rational exposition emerges in the case of a young atheist who might grow up to reject such myths, for then a detailed refutation of the scientific arguments he puts forward will be an appropriate and necessary replacement for the earlier training through myth. This dichotomy has support from a semi-serious etymology in the *Cratylus* which downgrades myth compared to reason. Socrates in this dialogue

suggests that the god Pan reflects in his name the whole of things (τὸ πᾶν), and, since Pan is son of Hermes, the god of speech, we infer that the whole of things can be signified in words. Yet the god Pan is bi-form, human above and goat below, and so the speech that he instantiates is double (διπλοῦς), both true and false; truth, which corresponds to the upper part of the god, is described as 'smooth and divine and living with the gods', and falsehood, the lower part, is 'rough and goat-ish, and belonging with the majority of the human race'.[4]

So, despite myths being acceptable as an educational tool for the young, Socrates can introduce into the discussion of his school syllabus in the *Republic* the concept of the 'truly false'; this is found as a result of being deceived by the plausible or from blind ignorance with regard to the topics that are rated most highly. As such it is said to be utterly abhorrent to gods and men, and inflicts lasting harm on the soul, the most important part of ourselves, in its most important concerns.[5] When, however, the innate falsehood is put into words and made as like the truth as possible, the result may be positively beneficial. Plato therefore regards Hesiod-type 'lies that are like the truth and with some truth in them' in two ways: on the one hand the myth-making of poets and orators is to be condemned as using persuasion and emotional appeal rather than correct teaching methods which foster reason, but, on the other hand, where we are dealing with the unknowable, myth-makers may produce something useful when their skilful verbal images bring the false close to the true.[6] Plato's treatment of Hesiod's tale of the Titan Kronos is a good example of this ambiguous approach. In the *Theogony* Hesiod tells of how Kronos mutilated his father and in turn was overthrown by his son Zeus; this, Plato says in the *Republic*, is 'the greatest lie (ψευδός) about the greatest subject' and, even if it were true and despite its antiquity, it has no place in his educational programme. But, in another context and another dialogue, Plato would recommend that Hesiod's tale in the *Works and Days* should definitely be published, for in that poem Kronos is an acceptable role-model, in that he was said to have inaugurated a golden age of happiness on earth, watched over by daimonic spirits of the departed who established for humanity secure peace, mercy, justice and law.[7]

One reason why the narrative structures that are characteristic of myth, if used with caution, might be helpful in preparing the way for more demanding topics is that they stay in the memory. We feel at home with what we are used to, just as we remember what we learned when young although we may forget recent events. For this reason Critias claims that he is accurately reporting the tale of Atlantis: 'it's true, as is said, that we well remember what we learned as children; I'm not at all sure that

I could recall what I heard yesterday but I should be very surprised if any detail of this story I heard so long ago escaped me; I listened to it with a child's delight'.[8] The Atlantis myth is an exceptional case, for here Plato uses the attractive characteristics of myth – vivid, enjoyable narrative and memorable detail – to bolster the plausibility of his own invention. But there are straightforward traditional myths from the past that can be productive of 'what is useful'. Most of the Platonic examples of these, as might be expected, come from the *Laws*. For example, when the Athenian wishes to advocate equal training in sports for girls and boys, he cites old myths about the Amazons; these are supported by evidence of women in his own time, in the same areas round the Black Sea, being as expert in horse-riding and archery as their men. More often old myths can be used as deterrents against wrongdoing, especially against robbery and murder, and as justification for appropriate punishments. There is, for example, an ancient myth cited in the *Laws* to the effect that justice is waiting to avenge a kinsman's blood, and that the homicide is haunted by his victim and must go into exile for a year, and, from the *Republic*, the horror of a tyrant's existence is a living *exemplum* of the myth told at the shrine of Zeus Lykaios that whoever tastes human flesh turns into a wolf.[9]

Not only is Plato ready to make selective use of such traditional myths in contexts in which a moral point to serve his own purpose may be made, but he adapts them to new purposes or invents new myths. So we have such 'thought experiments' as Gyges' 'ring of invisibility', which Glaucon uses in the second book of the *Republic* to challenge Socrates on the success of wrong-doing without fear of retribution, or a supposed resuscitation of Patroclus after his death at the hands of Hector in a reassessment of heroic courage, or the interesting case of the invention of writing, presented as a traditional story but then admitted to be an invented fiction.[10] Less pleasant examples are the Myth of the Metals, that famous 'noble lie' to be used as propaganda to support the rigid class structure of the *Republic*, and the Myth of the Puppets in the *Laws* in which human emotions and reason are puppet-strings jerked about by the gods for their amusement.[11] Attempts to save these and even traditional forms of myth by interpreting them as straightforward allegories are generally not successful. Socrates refuses to play this game in the *Phaedrus* when it is suggested to him that the myth of the abduction of Oreithyia by Boreas might mean simply that she was blown to her death by the north wind, nor does Socrates allow allegory as a way of preserving Homeric myth in the *Republic*; when he does quote a clever mythologizer in the *Gorgias*, who treats the myth of the punishment of the Danaids as an allegory for the insatiable life of the foolish, he gets short shrift from Callicles.[12] It is significant for the present

purpose that the one area in which allegory does work for Plato is in science, so that the truth in the myth of Phaethon's catastrophic ride in the sun's chariot refers to the declination of bodies moving round the earth; Prometheus' gift means that 'all things have in their nature a conjunction of limit and unlimited'; and the theory of 'perceiving' and 'perceived' in the *Theaetetus* is told according to a standard foundation myth of the birth of twins.[13]

These more serious examples of Plato finding his own philosophy in traditional myth have their converse in his tendency to view with a certain irony the philosophies of his predecessors as nursery stories. In this vein Socrates downgrades Protagoras' famous *dictum* that 'everyone is the measure of everything' to a *mythos*, as well as that of Theaetetus that 'knowledge is perception'. More to the point, the Visitor in the *Sophist* treats all the Presocratics as myth-makers when, in their cosmologies, they tell stories to us as if we were children, about wars, births, marriages and the like. The Visitor also reports the great disputes between the Materialists and the Eleatics in terms of the violent battle of the gods and the giants, and Heraclitus' insight into perpetual change as a derivation from the mating of the ever-flowing rivers Oceanus and Tethys, the eldest of the Titans in Hesiod's *Theogony*.[14]

To summarize Plato's position so far: generally he regards myths as plausible narratives likely to mislead, but useful in certain circumstances for persuading the young, provided that there is rigorous censorship to delete immoral precedent and emotional appeal. The advantages of the attractiveness of myths and their retention in the memory might perhaps, if used with caution, be incorporated into political programmes to reassure the vulnerable and naive, but in the adult world of philosophical dialectic they have no place. Here the greatest achievements of earlier thinkers are viewed as little more than glorified story-telling; faced with a sophist like Thrasymachus, an unscrupulous Callicles or a hard-hitting atheist, the philosopher needs his working tools of critical enquiry, assessment of evidence, verification and demonstrable proof. But surely someone who is going to give an account of the natural world will need these same tools? So why should Plato think that the study of natural science is a myth-making exercise, in which narrative is more appropriate than argument?

II. The epistemological status of Platonic myth

Before looking at the science-myth of the *Timaeus* it is relevant to glance at the epistemological and ontological status of the eschatological myths which Plato invented and narrated through the character of Socrates,

for these deal with a subject, after-death experience, which is beyond verification and the use of standard philosophical tools. There are four such myths, reported at the conclusions of *Gorgias*, *Phaedo*, *Republic* and in the central section of *Phaedrus*. The *Gorgias* narrative has many traditional features, telling the tale of the soul brought naked of worldly trappings and support before its judge, and sent by him either to Tartarus for punishment for crimes committed on earth or to the Isles of the Blessed for rewards. The moral drawn from the myth ties in with the general conclusion of the previous arguments in the dialogue, that the reality and not the appearance of justice is important here and now, and that punishment in this life is to be welcomed to restore the soul to health and avoid later more unpleasant consequences. The story is told only after Callicles has been driven by argument into submission, and Socrates addresses him as follows:

> Perhaps this seems to you to be like a myth told by an old woman, and you despise it, and it would not be surprising if you do despise it, if, in any way in our searching, we can find something better and truer than it.[15]

For the time being, Socrates adds, the myth has to be accepted since those present are not able to *prove* (ἀποδεῖξαι) that any life other than the one the myth advocates should be lived. Where proof is impossible a myth has to serve, but this is not a *cul de sac*; the present myth will yield to better (βελτίω) and truer (ἀληθέστερα) ones, if such are found. But what would be the criteria for one myth having more value or truth than another?

Socrates' attitude to the eschatological myth of the *Phaedo* approaches the problem from a slightly different angle. The long and complex story involves the description of a spherical earth held stationary by its own equipoise at the centre of a spherical cosmos. Our known world is only a small portion of the whole, and around the Mediterranean people live like 'frogs around a pond' with vast unknown regions beyond. The story also tells of the place of Judgment and the subsequent destinations firstly of the incurably wicked, then of those who may receive forgiveness, and thirdly of the good, finishing with a mention of the mansions awaiting the truly good, those who have been purified by philosophy. It is easy, Socrates says, to tell the tale, and he believes in it, but to *demonstrate the truth* of it is difficult if not impossible. At the end he makes this comment:

> To affirm positively that it is as I have reported is not appropriate for a person with *nous*, but that this or something like it is true concerning our souls and their dwellings (since soul clearly *is* immortal) seems to me an appropriate assumption and one worth risking – for fine is the risk (καλὸς ὁ κίνδυνος); the narrator should literally be enchanted by such stories, and that is why I have so prolonged the myth.[16]

A similar comment rounds off the Myth of Er in the *Republic*, which also has a complex setting, and which in this case involves an account of the heavens, the rotation of the planets and the harmony of the spheres as well as the transmigration of souls (topics which will all be picked up again in the *Timaeus*). In the crowning paragraph of the tenth and last book of the whole dialogue, which in parts had been much concerned with truth and knowledge and their superiority to opinion and conviction (πίστις), Socrates says that the story, told supposedly by a soldier returned from the dead, would save us (or keep us safe) if we were convinced by it.[17]

In Platonic theory, conviction belongs with opinion and is acceptable for day-to-day activities if the opinion on which it is based is right opinion (ὀρθὴ δόξα).[18] It is this which guides non-philosophic thinking and is available to humans generally. Given a complex subject such as the nature of the soul, Plato might in one context undertake a detailed philosophical analysis (as in books 2 to 4 of the *Republic*) but in another (in the *Phaedrus*) he might see it as a task reserved for a god, whereas what is less ambitious, and possible for humans, is to say what it *resembles* – this is a cue to launch into myth.[19] It is a stance similar to that of the *Phaedrus* that is adopted in introducing the cosmogony of the *Timaeus*. As the presenter says:

> If we can produce an account no less likely than any other we should be content, remembering that I who speak and you who judge have only human nature, so that it is appropriate that we should accept the likely myth (ὁ εἰκὼς μῦθος) on the subject and look no further than this.

We seem to be back in the world of the *Apology* where Socrates understood the oracular response, that no one was wiser than he, to mean that only god is wise, and human wisdom is worth little or nothing.[20]

Like the nature of the individual soul and what may happen to it after death, the early history of the human race is an area in which there is little scope for mortal wisdom or philosophical progress. In the absence of evidence, demonstration and means of verification, the only way to deal with the topic is to resort to myth. In the *Politicus*, for example, in the narrative of the world moving regressively from its original state of divine guidance to its present degeneration, the vocabulary of *mythos*, *logos* and even *apodeixis* is used almost interchangeably for the mythical explanation of the divine control of the movements of the cosmos. But the message is clear – the narrative has nothing to do with truth or certainty, but is a method of dealing with inaccessible material; indeed the myth is even useful in *correcting* an earlier conclusion reached by division and definition

on the nature of the true king and statesman.[21] Very similar is the Atlantis myth which is summarized by Critias in the *Timaeus* before the cosmology myth. No one knows what happened in prehistory, but a useful moral may be drawn from the troubles the human race brings on itself when it is further and further removed from its divine origins. Critias may attempt to make the tale of Atlantis and early Athens seem more authentic by calling it 'true' and giving it the backing of the wisdom of Egypt and the authority of Solon, but straightaway we are into an exaggerated form of standard foundation myth, with a god (Poseidon in this case) assaulting a mortal woman, fathering five pairs of twins and consequently setting up ten dynasties in a wondrous setting, reminiscent, in its exotic detail, of the 'true earth' in the *Phaedo* myth.[22]

The attractiveness and vivid narrative of the Atlantis myth, even in summary form, has made it a favourite through the centuries, both fascinating and intriguing its readers. It sets out to entertain when we are at ease, for, according to Critias, it is only when the necessities of life are provided for that we have the opportunity to engage in myth-making (*mythologia*) and enquiry into the past as leisure-time activities. However, before Socrates hears the Atlantis story in detail, Critias tells him about the other 'guest-gift' he will receive:

> Well, Socrates, we thought that because Timaeus is our most astronomical expert and has made it his chief concern to understand the nature of the universe, he should speak first, beginning with the becoming of the cosmos and concluding with an account of human nature.[23]

Socrates glows with anticipation at the feast of brilliant entertainment to come. But it is more surprising to find the theme of entertainment carried through well into the account, and into one of its most difficult sections, dealing with complex chemical changes in the mixing of metals. Such difficult scientific analysis is treated as an agreeable relaxation after hard metaphysics:

> There is no problem with pursuing further the other details [on metallurgy] in this type of likely myth (ἡ τῶν εἰκότων μύθων ἰδέα). Should anyone take a break, putting aside arguments about eternal being and considering instead likely accounts about becoming, he would gain pleasure with no regrets, and enjoy a moderate and sensible hobby (μέτριος καὶ φρόνιμος παιδία). So we shall continue with the probabilities that follow (τὰ ἑξῆς εἰκότα) ... (*Tim.* 59c–d)

The enjoyment derived from myth is often overlooked in the complex theorizing of its status, but it is there from the beginning. When, for example, in the *Odyssey* the minstrel Demodocus sings as a set piece the

tale of Hephaestus' entrapment of Aphrodite and Ares, Odysseus 'was delighted in his heart to hear it, as were all the Phaeacians'.[24] The story of the cosmos that will be told in the *Timaeus* is firmly set in the genre of leisure entertainment, a sophisticated version of stories told to children, treated with the same wry amusement with which, as we saw, Plato regards earlier attempts at natural science.

III. The ontological status of the subject of science

It has been shown that the areas in which hard philosophical argument is inappropriate and verification impossible include the origins of the human race, prehistory and what may happen to the soul after death. Such questions as when, where and how human life emerged, and whether there is any form of conscious survival after death, still remain unanswered, and we could add to these the present fascination with the origin of the universe itself. To quote from the latest best-seller on the subject:

> I have witnessed a widespread yearning to understand what current research says about the fundamental laws of the universe, how these laws require a monumental restructuring of our conception of the cosmos, and what challenges lie ahead in the ongoing quest for the ultimate theory.[25]

Several underlying assumptions here are reminiscent of Plato: that there are laws governing the structure of the universe, that these are intelligible, that a 'monumental restructuring' of previous approaches is required, and that the search is 'ongoing'. We put forward what seems at the moment to be the most likely account, but this will yield when another that is 'more probable' comes along.

The *Timaeus* taken as a whole links a story of the past, that of the defeat of Atlantis by early Athens, with the *polis* and its ideal citizen body constructed earlier in books two to four of the *Republic*. It then moves on to provide an argument for the metaphysics of the main philosophical section of the *Republic* (books five to seven), and launches into the elaborate narrative of the construction of world soul and world body, human body and human soul. This also involves a reworking of the cosmology of the Myth of Er in book ten of the *Republic*, a reaffirmation of the theory of transmigration found there, and a look back to the complexities of the geographical science of the *Phaedo* myth and its concept of rebirth. But the *Timaeus* also provides the 'monumental restructuring' that Socrates required of natural science earlier in the *Phaedo*. There Socrates' first three attempts to prove the immortality of soul by rational argument failed in the face of the objections raised by two of those present. In particular there was the counter-suggestion of Cebes, that the soul

may go through a series of bodies but, if there is not a renewal of psychic energy, it will become gradually exhausted, so that there is no assurance that our present time is not its last life.

Before answering Cebes and providing a further proof, Socrates offers an autobiography of his own intellectual journey. In the longest passage in the Platonic corpus on the scientific achievements of the Presocratics, Plato, through Socrates, explains why these accounts are not satisfactory, treating them here not ironically as stories told to children but as serious yet misguided attempts at dealing with fundamental causation. The problem is not that the explanations the early philosophers offer might be mistaken, but that they are inadequate in that they are answers to the question 'how?' but not 'why?'. Asked, for example, why Socrates is sitting in prison the earlier physicists would reply in terms of the configuration of flesh and sinews and bones and sockets, whereas the true reason concerns right and wrong – Socrates would have taken his flesh and bones off to Megara if he had not thought it his moral duty to stay and face his execution. He concludes:

> One man puts a vortex round the earth to make the heavens keep it in place, another has the air support it. But they don't investigate the *dunamis* ('power' or 'ability') it has to be in its present position as the best possible, nor do they think that any divine force holds it, but suppose that one day they might discover some stronger and more immortal Atlas who will be better at holding everything together; they have no thought of the truly good and the necessarily binding that binds and holds the whole. I would most gladly have been a student of that sort of *aitia* ('causation' or 'explanation'). (*Phaedo* 99b–c)

The *Timaeus* is Plato's own answer to the objections he raised in the *Phaedo* against his predecessors' approach to cosmology. He sets out to show in the most positive terms and at the commencement of Timaeus' account that everything *is* in the place that is best for it, that all comes about according to a divine plan, and that the truly good binds the whole together:

> <The craftsman-god being good, with no envy in him> wanted everything to be good and as like him as possible, and so he took over all that was visible ...and brought it from a state of disorder into order, thinking this in every way better than the other... He put intelligence in soul, and soul in body and so constructed the whole to produce an artefact that would be the fairest and best that its nature would allow. In this way therefore, according to the likely account (εἰκὼς – 'likely', 'suitable' or 'imaging' – λόγος), we must describe this cosmos as in truth living, ensouled, intelligent, put into becoming through the providence of god (ἡ τοῦ θεοῦ πρόνοια). (*Tim* 29e–30c)

Divine providence is the cause of the generation of the cosmos, binding it fast, and this will be the subject of the 'likely account' that is to be unfolded.[26] And obviously the ironic, knowing-nothing Socrates cannot be the one who unfolds the account, but the task is given to Timaeus, probably a fictional character, who is said to come from south Italy, the centre of Pythagorean science and cosmology, and who is engagingly described as ὁ ἀστρονομικώτατος, 'that most astronomical expert'.[27]

The *Timaeus* has close ties, as had been shown, with the *Phaedo* in providing the teleology that was wanting in previous accounts of the natural science, and in the use of myth for the unverifiable. It is unambiguously stated at the beginning of the *Timaeus* that it is a continuation of the conversation of the *Republic* which took place the day before.[28] The main details of the political construct of the *Republic* are summarized in some detail at the beginning of the *Timaeus*, the myth of the early Athenians' defeat of Atlantis which follows shows how the brave and just citizens of the *Republic* might act if 'brought to life', and the cosmology myth of the *Timaeus* elaborates in some respects on the complex astronomy of the *Republic*'s final eschatological myth. There are also links with the *Phaedrus* in the pattern of extended monologues rather than sharp dialectic, in the myth there with its cosmic setting, and with the general elevated style of language for which Socrates apologises, with some embarrassment. *Phaedo*, *Phaedrus*, *Republic* and *Timaeus* belong together in myth and metaphysics, and are mutually dependent; that Socrates is not the main speaker in *Timaeus* is required by the subject-matter, and does not affect its close ties to the other three dialogues. The *Critias*, which follows *Timaeus*, and which was to recount in great detail the Atlantis myth, stops in mid-sentence on the eighteenth page, not because this is a final work of Plato's, broken off in his old age, but because the framework of myth, which was appropriate in Platonic theory for a scientific account of cosmology, became irrelevant and perhaps even tedious when applied to a particular pseudo-historical event.[29]

A fresh start was made with the *Parmenides*, which has as its chief character the great Presocratic, 'father Parmenides', who initiated the whole dichotomy between *alētheia*, truth judged by reason, which denies the evidence of the senses, and *doxa*, human opinion, reliant on perception, which has no truth in it. It was Parmenides who put his account of the cosmos with the latter, linking it with *doxa* rather than *epistēmē*. In Parmenides' poem the goddess says to the young man who has travelled so far to hear her, after she has given the hard-hitting arguments for the nature of what really exists:

> Here I end my reliable argument and thought concerning truth. From

this point on learn the opinions of mortals, as you listen to the deceptive arrangement of my words... You shall understand the nature of aether and all the signs therein, the obscure functions of the bright sun's pure torch and their origin, the movements and nature of the round-eyed moon, and you will understand too the origin of the encircling sky, and how necessity tied it down to hold the limits of the stars.[30]

Plato has learned from Parmenides the dubious status in epistemology and ontology of any account of the natural world, and how unfavourably it compares with the certainty of deductive argument. After the *Timaeus* and its cosmology a younger Socrates is represented in the *Parmenides* as being reprimanded by his elderly mentor for indulging in metaphysics before he has been through a rigorous intellectual training. In the second part of that dialogue Parmenides gives an example of the rigour required when he engages in intensive dialectic in the presence of an expert trainee-logician, Zeno of Elea. As Zeno says:

Ordinary people don't realize that without this comprehensive training we cannot hit upon the truth and gain understanding.[31]

Socrates, who had listened with wonder and enjoyment to the great scientific discourse of Timaeus, is represented as making all sorts of metaphysical assumptions too quickly and too enthusiastically, before he has honed his methodology.

So, as the historical Parmenides produced an avowedly untrue cosmology, Timaeus in Plato's eponymous dialogue gives an exposition labelled as 'likely myth'. Parmenides had his own reasons for downgrading a system which required a plurality of elements and a motive force, but why should Plato write a long sophisticated account of the universe, bringing in some of the latest discoveries in astronomy, mathematics and medicine, and treat it as (merely) agreeable relaxation, an entertaining story for adults at leisure?

IV. Narrative, knowledge and opinion

Stable, enduring knowledge has as its object changeless, enduring reality, and for Plato, in his central dialogues, this is what exists independently, 'itself by itself', as a 'form' in the realm of being. It is the *Timaeus* which comes closest of all the dialogues to offering a proof for the so-called 'theory of forms'. 'Is there a form of fire, and do all those entities exist which we keep saying are each on their own by themselves?' asks Timaeus,[32] the basic question to be answered in order to establish the theory that had been assumed and accepted in the *Phaedo*, *Phaedrus* and *Republic*, and which would be criticized in the *Parmenides*. Timaeus admits that he does

not want to go into a further lengthy digression in an already extended discourse, but, on the other hand, it would be uncritical and unjustified to dismiss the problem and merely take it for granted that forms exist. The proof comes at the key stage in the exposition, before the central section which will explain the three distinct realities of being, space and becoming and show how order is imposed on disorder, to produce a copy of the eternal in the perceptible universe. And it is here that the crux of the problem, the status of the narrative, is to be resolved.

We must make some logical distinctions, says Timaeus. Can we accept a distinction between understanding (*nous*) and true opinion or belief (*doxa alēthēs*), i.e. between understanding working independently of perception and true opinion grounded in the results of sense-data? Admittedly, Timaeus concedes, there are those who take what is perceived through the body as completely stable and reliable, and that indeed what we see, or otherwise perceive through the body, is all that there is, and that there is nothing else besides. But, he argues, it can surely be claimed that understanding and true opinion are separate since they differ in origin, and it is possible to have one without the other. Understanding comes to us through learning from within, whereas the opinions we hold are the result of persuasion imposed externally. So when one has understanding then its conclusions can always be defended in argument and will not shift as the result of counter-persuasion, but opinion, even true opinion, cannot give an account of what it believes and is therefore always liable to change according to the strength of a persuasive attack on it. Humans generally have opinions, but gods and very few mortals achieve understanding.

Once this distinction between understanding and opinion or belief (*doxa*) has been established, Timaeus continues, very much as Socrates had done at the end of the fifth book of the *Republic* (475b–80a), by connecting them with different objects. What we have opinions about, like the faculty of opining or believing, results from the use of our senses and belongs in the perceptible world. The objects of perception come and go in different places and start and stop at different times with the result that there is nothing permanent to latch on to, and so no surety in the resulting *doxa*. But, since understanding has been agreed to be different from *doxa*, it will have a different object of study, and this will be what there truly is, which does not change or shift or start and stop – out of range of the senses, not taking into itself anything external to it nor entering into anything anywhere, but existing independently, accessible only to its appropriate faculty, *nous*.

The argument on the distinction between knowledge and opinion in the *Republic* had started from different objects of *love*.[33] Philosophers

are lovers of wisdom and truth, to be distinguished from the lovers of sights and sounds and crafts; the former, and they are very few, are able to reach beauty itself, the form of beauty, and so have knowledge, whereas most people enjoy particular beautiful things, and have opinion (*doxa*) concerning them. It is a straightforward decision, Socrates claimed there, to recognize that knowledge is of what there is and ignorance, its opposite, concerns what is not; opinion however seems to be intermediate between the two mental states of knowledge and ignorance, and so one would expect there to be a corresponding intermediate focus for it, somewhere between what is and what is not. This turns out to be what concerns the lovers of sights and sounds, for sights and sounds which at one time or in one context can be beautiful, at another time and in another context will be ugly, and similarly with big and small, light and dark, just and unjust. Such objects cannot *be* to a greater extent than what there is, or *not be* to a greater extent than what is not, and so they belong between the two, 'rolling around' between what is not and what purely is. The philosophers therefore, truly wisdom-lovers, having knowledge of what is, are set apart from ordinary, practical people[34] who are characterized by *doxa* concerning constantly changing particulars and are to be called *philodoxoi*. This distinction between understanding and opinion continues in the *Republic* through the central sections concerned with the Simile of the Sun, the Diagram of the Divided Line and the Allegory of the Cave. In each case the visible world of becoming, of what comes and goes and has no permanent identity, has its counterpart in the intellectual realm of being – eternal, unchanging, ever as it is. Certainty belongs here, but guessing, and at best a resemblance of truth, with the former.

V. Philosophy, science and cosmogony myth in the *Timaeus*

The basic premise of the *Timaeus* builds on the distinction which is at the heart of the metaphysics of the *Republic*: that philosophers, concerned with truth, do not study natural science, or at least not as their main pursuit, for the structures and functions of the world around us constantly shift, its objects have no permanent identity and conclusions about them therefore belong with *doxa*, opinion, and not with *nous*, intellect. The distinction was not relevant to the Atlantis myth, but when Critias has finished the summary of that narrative, Timaeus, now the main speaker, reinforces the contrast between *being*, that which is, and *becoming*, what comes and goes, as a prelude to the cosmology myth:

> We should, I think, first establish the following division: what is it that always *is*, having no *becoming*, and what is always *becoming* and never *is*? The one is grasped by understanding working with reason, ever being as it is, the other is opined through opinion, becoming and perishing, working with non-reasoning perception, and never actually being.[35]

Timaeus then goes on to ask whether the whole *ouranos* or *kosmos* (or whatever we like to call it) is ever-existing, or does it belong with becoming (γέγονε), having its origin in some first principle (ἀρχή). The answer is that it belongs with becoming (γέγονε). Confirmation that γέγονε here means 'belongs with becoming' rather than 'came-to-be' or 'had a specific starting-point' is in the following γάρ, 'for'.[36] The reason is given for its belonging with becoming, namely that it is visible and tangible and has body. Everything like that is perceptible, and, in being perceptible, it is grasped by opinion drawing conclusions from the results of perception.

Following from this line of reasoning, Timaeus then has to trace the first principle (*archē*) which exists of itself and provides a cause or explanation (*aition*) for the perceptible cosmos that has this status of 'becoming' but not 'being'. He assumes, or, for the purposes of the narrative, tells the story of, a 'maker and father of the whole' to which he gives the title *dēmiourgos*, 'craftsman', i.e. a workman of the people, an ordinary technician comparable to a carpenter or potter. And indeed the divine *dēmiourgos* works as a carpenter would, making from the material available a copy of an original model.[37] But since the world is most beautiful and the craftsman most good, the model used, the *paradeigma*, is eternal, grasped by reason and wisdom, and this world is a copy (*eikōn*) of it. The difference between model and copy follows that of being and becoming – the one eternal and unchanging, the other perceptible and subject to change.

But Plato, through Timaeus, goes further than this. The noun εἰκών (*eikōn*, 'copy' or 'image' in Greek, from which the word 'icon' is derived) has the same root as the verbs εἰκάζω (*eikazō* – 'I guess') and ἔοικε (*eoike* 'it resembles' or 'it seems'), the participle εἰκώς (*eikōs*, 'suitable') and its neuter plural with the article τὰ εἰκότα for 'what is probable', the abstract noun εἰκασία (*eikasia* 'guessing', the state of mind given in the Diagram of the Line in the *Republic* to those looking at shadows and reflections, 511d), and the related adverb εἰκῇ, often translated 'randomly'.[38] It is because of these shifting meanings that we find the apparently surprising conclusion that an *account* of something has the same epistemological status as its object. Accounts of paradigms, of what is fixed and stable, can be made irrefutable by logic, but accounts of copies and likenesses are probable at best, for, as being is to becoming, so truth is to convincing guesswork. Therefore, Timaeus says:

> Don't be surprised, Socrates, if we are not capable of producing accounts on a great many subjects, including gods and the becoming of the cosmos, that are in every respect consistent and accurate; we must be content if we

come up with probabilities (*eikotas*) no less likely than any other...accepting the likely myth (εἰκὼς μῦθος) on the subject and looking no further than this.[39]

Being and becoming, model and copy, original and image bring with them the contrasting pairs of truth and probability, dialectic and myth. This means that the study of the natural world, in the myth of the *Timaeus*, does not involve an enquiry into eternal laws or philosophical arguments about metaphysics, but a plausible narrative that is to be assessed according to a range of probabilities.

Timaeus as spokesman claimed that the world of becoming requires some kind of first principle or cause to maintain it, and that is why he introduced the divine craftsman. And when he classified the cosmos with becoming rather than with being he explained that this was because it comprises particulars that are continually characterized by birth and death, appearing and perishing, and we saw that this does not imply that the perceptible world as a whole has a starting-point. But the *narrative* has to begin somewhere, and so we are presented with the stages of reasoning in the mind of the demiurge which explains the formation of the cosmos as the best possible, as Timaeus relates:

He put intelligence in soul, and soul in body and so constructed the whole to produce an artefact that would be the fairest and best that its nature would allow. In this way therefore, according to the likely and imaging account, we must describe this cosmos as in truth living, ensouled and intelligent, put into becoming through the providence of god.[40] (*Tim.* 30b–c)

In addition it is *monogenēs*, the only one of its kind, resembling the unique model even in this feature of uniqueness, the one and only artefact of the divine craftsman. The description of the body of the world follows from this introduction, and this is said to be constructed from four elements arranged in geometric proportions, with two outer and two connecting middle terms, to provide a three-dimensional sphere, rotating on its axis. Next comes the formation of the world soul – its composition from a mixture of intermediates, and its division into the outer circle of the Same for the fixed stars, and the seven inner circles of Different to give the orbits of the planets; then the world soul is fitted right through the world body. Of course, Timaeus adds, the demiurge did not really construct the soul *later* than the body so that the soul is the younger, but any narrative requires an apparent sequence of events. Here the earlier relationship of an account of likely or probable contingent events being itself no more than likely or probable is reinforced. Since we ourselves have a share in much that is random and the result of chance,[41] what we have to say has

the same characteristics:

This distinction must be made concerning a copy and its model: *logoi* are related to the subjects they explain. So *logoi* of what is stable, secure, clear and rational are themselves stable and not shifting – as irrefutable and immovable as arguments can be, whereas *logoi* of a copy or image are similar to it, i.e. the *logoi* relating to what is a likeness are, analogously, likely, for as being is to becoming so is truth to belief. (*Tim.* 29b–c)

VI. Mathematical models

In a later section, after the description of world soul and world body, and before starting on human body and human soul, there is one more attempt to explain how the model is eternal, whereas the constructed cosmos is in time. The narrative, the scientific myth, is recognized as using present, past and future tenses, but without carrying with it the implication of an actual starting-point. The model belongs with being, which means not only that it has no beginning or end, but no past or future or even present – the temporal 'is' is inappropriate for it. And because the demiurge wanted the copy to be as like the model as possible, it too has no beginning or end. But the copy is set in time, which is defined as 'a moving image of eternity', and we use tenses of it, *was* for past, *is* for present and *will be* for future. The tenses – past, present and future – are related to days and months and years, and these are regulated by planetary movements. The story therefore requires a description of the formation of the planets and the plotting of their orbits, but, as was explained before the details were spelled out, 'the model, the *paradeigma*, is in being for the whole of eternity, whereas the copy, for the whole of time, was, is and will be always in a state of becoming'.[42] Being eternally exists outside of time, whereas becoming is always becoming, set in time; the narrative of becoming, the scientific myth, has a starting point, but otherwise shares in the ever-shifting nature of its objects.

There is one further complication. What exists eternally exists independently of time, but also of spatial limits, whereas becoming belongs with time and in addition has to be spatially extended – world body and world soul, human soul and human body have to be positioned somewhere. So, having described the demiurge constructing a likeness of an eternal model, Timaeus goes back to consider the material with which he works, the underlying disorder on which order is imposed, and, in the context of the whole subject of cosmology, the third entity, space (*chōra*) is introduced, and this is how it is described:

Space exists always and cannot be destroyed; it provides a location for all

> that becomes; it is apprehended by a kind of illegitimate reasoning which does not involve perception and we cannot be sure about it. We seem to be in a dreamlike state when we say that everything has to be somewhere, in some place (*topos*) and occupying some space (*chōra*), and what does not exist somewhere, whether on earth or in the sky, does not exist at all. (*Tim.* 52b)

But Timaeus encourages us to wake up from this dreamlike state and realize that what *becomes* becomes in space, but what *is* exists quite independently. There are these three – being, space and becoming – and the cosmos is now to be understood as a copy *in space* of an eternal model, an image of an original, like a father's child from the womb-like 'receptacle'.

It is in this context that we have what may be considered one of the most important contributions to the history of science – the understanding of the mathematical structure of the universe. Plato claims that what appears to our senses to be most vivid and most real, from the smallest living organism to the vastness of the whole cosmos, is resolvable into mathematical formulae. These formulae are themselves the 'elements of elements', capable of explaining the laws of physics, chemical transformations and biological structures, on both a large and a small scale. And when set in space they take on the appearance of perceptible individual entities in somewhat the same way as higher (pure) mathematics applies to modern cosmology or the analysis of DNA strings to biological theory.[43]

Two final points may be made. In Plato's time arithmetical notation was in disgrace after the discovery of irrational numbers, and algebra had not yet, as such, been invented; he therefore uses geometrical formulae for his mathematical structures. The method may well seem clumsy, but it has the advantage of keeping in the forefront the concepts of proportion, measure, harmony and ratio which are so crucial to Platonic theory. And secondly, as in the *Republic* the years spent on the mathematical curriculum were recommended as an essential preparation for dialectic, so the astronomy, physics and mathematics of the *Timaeus*, while relegated to recreation, are serious pursuits in that they provide resources for the *genre* of philosophy.[44]

Conclusion

In summary we have found that the formation of world soul and world body, human body and human soul, is narrated as a myth in the *Timaeus*, with its subject-matter firmly centred in the realm of becoming; as such it has no reality in the Platonic sense of timeless and perfect self-identity, and a description of it can be no more than a likely account (εἰκὼς λόγος). The heavens, with the circles of the fixed stars and planets regulated by

number, imitate to the greatest extent possible the uniformity and eternity of the model, but in the human sphere the resistance of the material to the designer's plan results in a continuous struggle for permanence and order. Although the struggle cannot succeed, given our impermanent and contingent state, progress *is* possible; correspondingly, accounts of the natural world will never reach truth, but scientific advance is achieved by the continuous replacement of one theory by another that is 'more probable'. So on the one hand Plato plays down his long narrative of massive structures and careful details in the *Timaeus* as merely entertainment, light relief from the hard work of metaphysics, and devoid of truth, but on the other he gives his own interpretation of the latest achievements in the sciences as a contribution to the ongoing debate about the physical world in a celebration of elegant and rational design.

Notes

[1] Hesiod *Theog.* 27–8: ἴδμεν ψεύδεα πολλὰ λέγειν ἐτύμοισιν ὁμοῖα, | ἴδμεν δ', εὖτ' ἐθέλωμεν, ἀληθέα γηρύσασθαι.

[2] *Rep.* 377a: τοῦτο δέ που ὡς τὸ ὅλον εἰπεῖν ψεῦδος, ἔνι δὲ καὶ ἀληθῆ.

[3] *Laws* 887d: τοῖς μύθοις οὓς ἐκ νέων παίδων ἔτι ἐν γάλαξι τρεφόμενοι τροφῶν τε ἤκουον καὶ μητέρων, οἷον ἐν ἐπῳδαῖς μετά τε παιδιᾶς καὶ μετὰ σπουδῆς λεγομένων καὶ μετὰ θυσιῶν ἐν εὐχαῖς αὐτοὺς ἀκούοντές τε, καὶ ὄψεις ὁρῶντες, and cf. 890b–d.

[4] *Crat.* 408b–d; there is a further pun in that *tragikon* means both 'goat-ish' and 'belonging to tragedy', and 'false myths' were the subject-matter of tragedy.

[5] τὸ ὡς ἀληθῶς ψευδός, *Rep.* 382a,b; τὸ τῷ ὄντι ψευδός, 382c and cf. the whole argument 382a–e.

[6] *Rep.* 382d; the condemnation of the myth-making of poets follows here and in books 3 and 10; on similar criticism of the orators cf. *Pol.* 304c; Protagoras' persuasive myth, reinforced by logos, was unable to deal with Socratic elenchos, *Prot.* 328c–29b.

[7] *Rep.* 377e, cf. the distinction at *Rep.* 522a in education in music and literature between the *logoi* that are myth-like and those that are truer (ὅσοι μυθώδεις τῶν λόγων καὶ ὅσοι ἀληθινώτεροι ἦσαν); *Laws* 713b–e, and here the myth (μῦθος | φήμη) becomes a logos with the addition of the moral.

[8] *Tim.* 26b; cf. Aristotle similarly at *Met.* 995a.

[9] *Laws* 804e, 865d, 872d, 913b, *Rep.* 565d.

[10] Gyges' ring *Rep.* 358d; Patroclus *Laws* 944a; the myth of Theuth *Phaedrus* 274c–75b.

[11] Myth of the Metals *Rep.* 414b; Myth of the Puppets *Laws* 644d–45b; again (cf. note 7), with the addition of the moral, the *muthos* becomes a true *logos*, a guide for individual life and political prosperity.

[12] *Phaedrus* 229c–e, *Rep.* 378d, *Gorgias* 493a–94a, and cf. the δεῖνος ἀνήρ

Phil. 28c, *Laws* 885b, and for the myth of Ganymede *Laws* 636d; cf. Aristotle on 'the subtle mythologists' (οἱ μυθικῶς σοφιζόμενοι) who do not deserve to be taken seriously *Met.* 1000a10.

[13] *Tim.* 22c, *Phil.* 16c, *Theaet.* 156b; cf. Aristotle on Atlas, *Met.* 1023a17–21, *DC* 284a18.

[14] *Theaet.* 164d, 180c–d, *Soph.* 242c–d, 246a.

[15] *Gorgias* 527a. This is the final verdict; earlier Socrates had said that the account, which Callicles would call a *muthos*, he calls a *logos*, and is convinced of its truth, cf. 523a, 524a–b, 526d.

[16] *Phaedo* 109d, 114d.

[17] *Rep.* 621b–c: καὶ οὕτως, ὦ Γλαύκων, μῦθος ἐσώθη καὶ οὐκ ἀπώλετο, καὶ ἡμᾶς ἂν σώσειεν, ἂν πειθώμεθα αὐτῷ...

[18] *Meno* 97a–c, with the example of a successful journey to Larissa from directions based on true opinion.

[19] Cf. *Phaedrus* 246a.

[20] *Tim.* 29d, *Apol.* 23b.

[21] Cf. *Pol.* 274e, 277a–c.

[22] *Tim.* 21a–26d, *Critias* 113b–17a, *Phaedo* 110b–11a, and cf. above, note 10 for another myth from Egypt, that of the inventor Theuth, which Socrates first claims to be true and then admits he made up.

[23] *Tim.* 27a: ἔδοξεν γὰρ ἡμῖν Τίμαιον μέν, ἅτε ὄντα ἀστρονομικώτατον ἡμῶν, καὶ περὶ φύσεως τοῦ παντὸς εἰδέναι μάλιστα ἔργον πεποιημένον, πρῶτον λέγειν, ἀρχόμενον ἀπὸ τῆς τοῦ κόσμου γενέσεως, τελευτᾶν δὲ εἰς ἀνθρώπων φύσιν.

[24] *Od.* 8.365–7.

[25] Greene 1999, Preface p. x.

[26] *Tim.* 30a–b; I do not think that there is any subtle distinction between reason and myth to be found in the phrase εἰκὼς λόγος here and εἰκὼς μῦθος in the preceding paragraph, 29d. Plato tends to use *mythos* and *logos* interchangeably (cf. *Pol.* 277a–c where in the same sentence *mythos*, *logos* and even *apodeixis* are used for the myth/story/explanation/account of the god's control of cosmic movement). It is the ontological status of the subject being discussed, not *mythos/logos* terminology, which decides whether dialectic or narrative is the more appropriate.

[27] *Tim.* 27a. Some features, such as transmigration, the interest in number, harmony and proportion, and, possibly, the harmony of the spheres, may be due to Pythagorean influence, but this is not to countenance the malicious rumour (reported by Diogenes Laertius 8.85) that Plato plagiarized the whole narrative from a Pythagorean source; cf. McClain 1978, ch. 5.

[28] χθές, 'yesterday' is repeated, *Tim.* 17c, 19a. The earlier dating of the *Timaeus*, first put as following the *Republic* by Owen 1953, was immediately challenged by Cherniss 1957 and the controversy has continued; most recently in favour of the earlier dating is Robinson 1992, and cf. Ostenfield 1986.

[29] On the unfinished *Critias* cf. Gill 1979.

[30] Parmenides frs. 8.50–2, 10.1–7; how 'necessity tied it down' is Parmenides' way of saying that such are the laws of nature.

[31] *Parmenides* 136e.

[32] *Tim.* 51b; the discussion covers the section 51b–52c, picking up the earlier discussion at 27e–28b.

[33] *Rep.* 475b–80a.

[34] οἱ πρακτικοί *Rep.* 576a.

[35] *Tim.* 27d–28a: τί τὸ ὂν ἀεί, γένεσιν δὲ οὐκ ἔχον, καὶ τί τὸ γιγνόμενον μὲν ἀεί, ὂν δὲ οὐδέποτε; τὸ μὲν δὴ νοήσει μετὰ λόγου περιληπτόν, ἀεὶ κατὰ ταὐτὰ ὄν, τὸ δ' αὖ δόξῃ μετ' αἰσθήσεως ἀλόγου δοξαστόν, γιγνόμενον καὶ ἀπολλύμενον, ὄντως δὲ οὐδέποτε ὄν.

[36] *Tim.* 28b: πότερον ἦν ἀεί, ἢ γέγονεν; γέγονεν· ὁρατὸς γάρ... The perfect tense applies to the present state of affairs. The aorist ἐγένετο would be needed for 'was created' (Jowett), 'came to be' or even 'has come to be' (Desmond Lee, Penguin translation); D Zeyl, in John Cooper's edition of *Plato Complete Works* (Hackett 1997) has both: 'Did it come to be? It has come to be'.

[37] Cf. *Crat.* 389b, where a carpenter makes a shuttle as the best copy he can of the model provided by the pre-existing 'form'.

[38] Cf. *Tim.* 34c ἀλλά πως ἡμεῖς, πολὺ μετέχοντες τοῦ προστυχόντος τε καὶ εἰκῇ, ταύτῃ πῃ καὶ λέγομεν, 'we, sharing for the most part in chance and the likely, somehow speak in this sort of (chance and random) manner'.

[39] *Tim.* 29c–d; the language is similar to that of Parmenides in that no truth attaches to his cosmology, but it is likely (ἐοικότα), and superior to any other, cf. Parmen. fr. 8.50–1, 60–1.

[40] *Tim.* 29e–30c, cf. above, section III.

[41] *Tim.* 34c, cf. note 38.

[42] *Tim.* 38c: τὸ μὲν γὰρ δὴ παράδειγμα πάντα αἰῶνα ἐστιν ὄν, ὁ δ' αὖ διὰ τέλους τὸν ἅπαντα χρόνον γεγονώς τε καὶ ὢν καὶ ἐσόμενος.

[43] Cf. for example Greene 1999, ch. 14 'Reflections on cosmology' and Wolpert 1993, 74–7, discussing the work of Crick and Brenner on ribosomes in molecular biology.

[44] *Rep.* 524d–31d , *Tim.* 47a.

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2

HOW TO BUILD A WORLD SOUL: A PRACTICAL GUIDE

Sergio Zedda

In this paper, it is my intention to explore some of the issues arising from the practical actions of blending the ingredients of which the world soul is made, and then of working with the resulting mixture. I shall focus mainly on the practical difficulties involved in describing at the same time a process of cosmogonic generation and the act of building a physical representation of it. This starting point opens the way for a number of questions, centring on the implications of the puzzling claim, made at *Timaeus* 40c–d, that a visible model of the universe is a necessary requirement towards providing an accurate description of the planetary circles and movements. There are numerous practical reasons for using a diagram of the universe in order to help our understanding of its complex structure. The explicit use of a diagram, in this case an armillary sphere representing the universe, is not fully consistent with the traditional interpretation of the Platonic refusal to consider generated objects as valid instruments towards achieving knowledge. In the last part of this paper, I shall draw on the mathematical passages detailing the subdivision of the world soul to suggest that Plato intended the readers to use the description as an intermediate term between objects of becoming and the model which inspires the demiurge.

I. Theory in practice: making the world soul's stuff

The declared starting point for the construction of the cosmos, including the physical and visible world, is the blending of the three kinds – Being, Sameness and Difference – into a new material, which Plato describes as the soul of the generated universe. This new substance, the world soul (τὴν τοῦ παντὸς ψυχήν), embodying all that is rational and intelligible, he causes to be at the centre of the universe, and to be interwoven at all levels of the generated world: ψυχὴν δὲ εἰς τὸ μέσον αὐτοῦ θεὶς διὰ παντός τε ἔτεινεν.[1] In the universe as built by the demiurge, the world soul is

present throughout the entire universe, where its visible manifestation consists of the planetary paths. The account in the *Timaeus* is strongly linked with the physicality of the subject matter and suffers from a number of limitations and inconsistencies which are inherent in any account of natural history. The most obvious of these limitations is that a description of natural phenomena has to be by definition a description of visible objects, i.e. of particulars. Within the dialogue itself, the passage which more than any other emphasizes the problem of the relationship of generated and intelligible, and the relationship of object and image is that at *Timaeus* 40c–d, where Plato appears to be saying that in order to describe the 'choric dances' of the planets-gods a visible model is a necessary requirement:

> to describe all this without visible models of these same would be labour spent in vain (d3–4: τὸ λέγειν ἄνευ δι' ὄψεως τούτων αὖ τῶν μιμημάτων μάταιος ἂν εἴη πόνος).[2]

What Plato is implying is twofold: on the one hand there is a clear admission that description in words is not always the most appropriate medium for the work of 'understanding' the construction of the universe. This problem is often indicated in the dialogue, and results first in the apparently strong distinction between that which is existent and that which is becoming, and then in the frequent warnings that the tale of Timaeus is no more than a 'likely account'.[3]

On the other hand, the claim that the best way to understand a constructed object, the cosmos and its planetary movements, is by looking at a man-made copy, is at least puzzling, since it raises the question how a crude reproduction of the universe as generated by the demiurge can help in understanding its movements. The problem, broadly stated, consists in the fact that both the universe and the armillary sphere which represents it are firmly placed within the realm of becoming; as such, both can be said to be copies of a model. The cosmos, however, is described as the copy of the perfect model, as at *Tim.* 30c4–d5, and, because of its direct link with the rational mind of the demiurge, would itself be as perfect and complete as possible.

As a mere copy of the generated cosmos, however, the armillary sphere should, by the warning expressed in the same passage, be discounted as a possible aid to understanding. As a man-made object, the armillary sphere can only be an inaccurate representation of the real object, in the same way that a painting or sculpture would be of its Form, whereas the demiurge uses as the model for the cosmos the unchanging Form of the living universe (*Tim.* 28c7–29a4). As explicitly stated by Timaeus,

nobody should entertain the possibility that the demiurge could have generated the world as a copy of a copy; in fact, this possibility is equated with blasphemy at 29a4:

> If this cosmos is beautiful and the demiurge good, it is plain that he looked to the eternal, but if otherwise, which is impious for anyone even to say, to becoming (εἰ δέ, ὃ μηδ' εἰπεῖν τινι θέμις, πρὸς γεγονός).

In the passages dealing with the creation of the world soul at *Timaeus* 35a8–36d9, and those concerned with the construction of the human soul at 41d5, Plato describes the actions of the demiurge as determined by the practical need to construct, and account for, a world that, as visible and tangible, must bear a recognizable resemblance to the world of particulars. It is not surprising, therefore, that the language he uses in the description of the generative actions of the demiurge should sound very much like the language of a craftsman involved in the making of an object. As rightly emphasized by Brisson (1994, 36–8), the language used in this section is highly reminiscent of the passages in the *Republic* describing the activities of the artisan class of citizens. It appears, however, that Plato is going much further than just using the 'language' of the craftsmen; what we are reading is a description of the actual, practical series of operations needed in order to construct a model, or representation, of the world soul. This model eventually will become the armillary sphere of which he speaks at 40d2–3.

The most obvious linguistic reference in the passage 35a1–b4, describing the construction of the world soul, is to the craft of metalworking. The ingredients are blended (συνεκεράσατο) together into a series of compounds which are treated as 'lumps' of solid material, to be placed where needed, forced into union (ξυναρμόττων) despite the difficulty (δύσμεικτον) involved in mixing them with Sameness, and then mixed again (μιγνύς) with Being. The resulting material is then divided and cut up (διένειμεν) as required.

Similarly, the passage at 41d4–7, describing the construction of the human soul, is based on a type of language more commonly associated with metalworking techniques than with metaphysics. Even more explicitly than at 35a, the action of mixing the ingredients is performed in the same κρατήρ used for mixing the world soul:

> He said this, and, turning once more to the same mixing bowl (καὶ πάλιν ἐπὶ τὸν πρότερον κρατῆρα) where he had already mixed and blended the universal soul, he melted down (κατεχεῖτο) what was left of the former ingredients, mixing them in the same way, only no longer so pure and invariable as before, but second and third in degree of purity.[4]

This same theme is picked up in the passage at 77a3–5, about the creation of vegetative life forms, where the verb κεραννύναι is again taken in its meaning of mixing by melting elements together. It is used to define the world soul (35a3–7), the human soul (41d5), and the soul of plants (77a5).

The term κρατήρ is normally associated with 'wine mixing-bowl', and the standard translation of κρατήρ remains that of 'mixing vessel'. As Brisson points out, however, we also find the word used, for example in *Phaedo* 111d4–5, to define any vessel in which mixing takes place. Furthermore, by taking the verb κατεχεῖσθαι in its middle meaning of 'cause to melt', he translates κρατῆρ as 'crucible'. For this usage of κατεχεῖσθαι, Brisson (1994, 37, nn. 5, 7–8) cites Herodotus, 1.50 καταχέαμενον χρυσόν and Pausanias 8.14.8 διέχεαν δὲ χαλκόν. The association with the language of metalworking is made quite explicit by the use of the verb κεραννύναι at *Timaeus* 77a3, the normal meaning of which is that of blending of different metals to produce an alloy, and in the use of the term ἀκήρατα to indicate the purity of the alloy. Herodotus again uses it to describe pure gold at 7.10.1.

A further indication that in the *Timaeus* passages Plato is describing a practical and not an abstract operation can be seen in the emphasis he places on the chronological sequence of the mixing or alloying process. In order to achieve the right mixture of world soul stuff, it is necessary for the three component elements to be at first reduced to a middle state, that of the intermediate mixture of Divisible and Indivisible Sameness, Being and Difference. Only then can the three be blended together, and even here we see the need for a sequential order of mixing, with Sameness and Difference being mixed first, and this first mixture then being blended with Being.

There is a clear similarity here between the account of the actions of the demiurge and the actual physical actions needed for the blending of an alloy composed of three metals. Even the fact that the three metals (in this case Being, Sameness and Difference) need to go through a first process of smelting to a higher degree of purity (the intermediate state), appears to be standard practice in order to guarantee the creation of a specific alloy with recognizable and quantifiable characteristics. There is little need to emphasize the fact that, in the metaphor of generation, the world soul is assimilated to an object made of metal. The alloy resulting from the blending process has to lend itself to such operations as laminating, cutting, and bending, and then needs to retain the shape given it by the demiurge. Only a 'high purity' alloy can be used to fulfil all the necessary specifications. Furthermore, of all the solid materials to be found in the

Platonic universe, metal presents the highest degree of purity because of its composition from particles of water.[5]

The difficulty encountered by the demiurge in creating the alloy is analogous to the difficulty any metal worker would have in producing a high-quality alloy. One of the problems in the making of, for example, brass, is that the metals needed for the operation have different melting points. The method commonly adopted in this case is to heat first the metal having the highest melting point, namely the copper. When this is molten the solid zinc is added and is quickly dissolved in the liquid copper before too much zinc has boiled away. Even so, allowance has to be made for unavoidable loss of zinc through evaporation. Consequently, in weighing out the metals before alloying, an extra quantity of zinc has to be added.[6] It is understood that a good artisan would know precisely how much wastage he should compensate for.

This is not to say that Plato wants us to understand the world soul as actually made of a tangible metal-like material. If any reference is present in the account of the blending, it is to the *difficulty* intrinsic in the performance of such a delicate operation as creating a named alloy made of three separate metals. The example of brass well illustrates this problem, and might account for the fact that brass, though known to the Greeks of the classical period, was little used because of the difficulty encountered in finding the right ores, and then in reducing them to a metal of consistent quality.[7] Similarly, the choice of a three-metal alloy, an even rarer material, might be a reference to *electrum*, a variable alloy mainly composed of gold and silver, often with the addition of copper or other material.[8]

All the references to the practice of alloy-smelting discussed so far appear to lead us towards two inferences. The first one is that Plato's use of the language of the craftsman, and his repeated use of metaphors linked to the process of smelting of metals, is a clear reminder that the process of creating the universe is a practical one, to be carried out by an artisan versed in the necessary *technē*. The craftsman in the *Timaeus*, like any good artisan in real life, must be capable not only of giving an account of his actions, but especially of guaranteeing that the result of an operation will not be determined by chance, but by firm and demonstrable knowledge of the process in question. In the case of the creation of the universe, the expected product of the demiurge's *technē* is the 'alloy' composing the world soul.

The second possible inference is that the entire process should be perceived as being so *difficult* and complex as to be beyond the ability of any human craftsman. Plato, in using the metaphor of the metalworker, is very careful to emphasize the fact that the inaccurate description of

the operation is due to the fact that Timaeus, for all his learning,[9] is no more than a human being, and as such will never be in possession of all the information which the demiurge, the true craftsman, had at his disposal during the generative act. Furthermore, Timaeus himself is not, and cannot be described as, a true expert in the relevant *technē*. When discussing something as specifically technical as the process of smelting metals in a crucible, Timaeus cannot provide his listeners with anything more reliable than an approximate account of the operation.

II. Applied theory: the mathematical subdivision of the world soul

The next step in the operation of building the newly rationalized demiurgic cosmos is that of taking the raw material, the world soul stuff, and reducing it to a flat surface on which lines and numbers can be scored. Plato is silent on this part of the process, only telling us, at *Timaeus* 35b1–4, that:

> having mixed it [the mixture of Sameness and Difference] with Being, he divided again this whole into as many parts as was fitting, each part being mixed from Sameness, Difference and Being.

Again, the imagery that appears from the text is that of molten metal being poured from the crucible to form a flat surface. That the resulting solid substance should be flat is a necessary assumption, since the demiurge will eventually have to perform operations like cutting and drawing on it. The text itself does not provide much detail at this point. Admittedly, Plato is not interested in telling his readers how the surface, which will form the circles of the world soul, is made by the metalworker. His aim, at this point of the account of generation, is to introduce the mathematical and musical notation according to which the world soul will be subdivided.

The process of subdivision involves the demiurge taking the strip of world soul material (as a craftsman takes a rectangular sheet of copper) and marking on it two types of lines: the first type, which is explicitly described, will remain inscribed on the circles of the Same and the Different (or Other) as the set of grid-lines underscoring the entire structure. This process of marking out the 'harmonic shape' of the world soul is a single operation, based on a set of elementary mathematical and harmonic proportions. This stage of the operation would create a rectangle, on which a series of intervals are marked. The regular rectangle would in all probability have been drawn on a sheet of copper, hammered flat and therefore irregular in shape.

The mathematical methodology behind the operation of subdivision of the world soul follows a basic pattern of two geometrical proportions

of four terms: 1, 2, 4, 8 and 1, 3, 9, 27. Each number represents a 'length' or 'portion', cut from the whole.[10] The starting point of the operation is the delimiting of a unit, the number one, which is common to both progressions, and the multiples of which will be used to create the remaining lengths.[11] The two progressions are based on the squares and the cubes of the first two numbers, two and three, as clearly stated in the text at 35c2–36a2.[12] The sequence, therefore, can be expressed as:

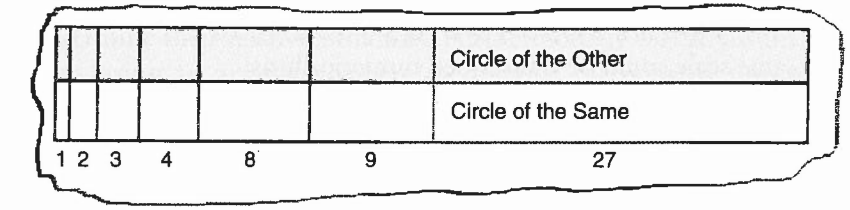
$1, 2, 3, 2^2, 3^2, 2^3, 3^3$, equivalent to 1, 2, 3, 4, 9, 8, 27.

That this is the process followed by Plato is clearly illustrated by the fact that in the text, the number 9 (3^2) comes before 8 (2^3) on account of the fact that 8 (2^3), as power of three, is higher than the power of two, represented by 9 (3^2). The decision to limit the sequence at 27 (3^3) is quite arbitrary.

In the choice of the proportions we can see that the progression provides a symmetrical geometrical sequence, which is fully in tune with the discussion on the perfect proportion at *Timaeus* 31b10–32b5c. On the strip of world soul material this would take the shape of:

1—2—3—-4———-8————9————————————27.

The first set of markings to be drawn on the strip of world soul stuff would look like the diagram below:



The numbers express the relative lengths of the segments marked on the strip of world soul stuff. This first phase of the mathematical subdivision provides the reader with a clear image, and the artisan with an explicit model, of the two main circles surrounding the planetary system. It will also provide the demiurge with the right intervals, drawn on the circle of the Other, from which to cut the individual planetary circles. Plato, however, continues with the harmonic subdivision at this point, with the intention of marking on the strips of world soul a complete diatonic musical scale. This part, the introduction of the harmonic and arithmetic means between the terms described above, is methodologically more complex and structurally more far-reaching. In it the demiurge, by 'filling up' the intervals between the delimiting spaces, constructs a series of intervals, resulting in a mathematically determined diatonic musical scale encompassing four octaves and a major sixth.

The step of filling in the intervals relies on the concepts of arithmetic and harmonic means. The arithmetic one presents no difficulty and is expressed by the formula $b = 2a = 1/2c$, as seen, for example, in the progression 2, 4, 8. The harmonic proportion, as defined by Archytas, is:

> by whatever part of itself the first exceeds the second, the second exceeds the third by the same part of the third.[13]

Alternatively, if a, b, c are in harmonic progression, and $a = b + a/n$, we must have $b = c + c/n$, whence in fact: $a/c = a{-}b/b{-}c$, or $1/c - 1/b = 1/b - 1/a$. An example of harmonic proportion is the sequence 12, 8, 6. This progression is supposed to be derived from the fact that the cube has 12 edges, 8 angles, and 6 faces.[14]

The proportion is:[15]

$$a : \frac{a+b}{2} = \frac{2ab}{a+b} : b$$

The filling in of the intervals gives rise to intervals of 3/2 and 4/3 and 9/8 (tone) within the original intervals. Again, the operation is performed in two separate steps: in the first the demiurge inserts the harmonic and arithmetical means between the successive terms of the series, resulting, after the omission of the intervals which are common to both processes, in the single series:

1 4/3 3/2 **2** 8/3 **3** **4** 9/2 16/3 6 **8** **9** 27/2 18 **27**

This same scale could be transcribed numerically as:

1, 1.3, 1.5, 2, 2.6, 3, 4, 4.5, 5.3, 6, 8, 9, 13.5, 18, 27.

In the second step the remaining intervals are filled:

> These links gave rise to intervals of 3/2 and 4/3 and 9/8 within the original intervals. And he went on to fill up the intervals of 4/3 (i.e. fourths) with the interval 9/8 (the tone), leaving over in each a fraction. This remaining interval of the fraction had its terms in the numerical proportion of 256 to 243 (semitone). By this time the mixture from which he was cutting off these portions was all used up.[16]

The resulting subdivision produces the following series:
1, 9/8, 81/64, 4/3, 3/2, 27/16, 243/128, 2, 9/4, 81/32, 8/3, 3, 27/8, 243/64, 4, 9/2, 81/16, 16/3, 6, 27/4, 243/32, 8, 81/8, 32/3, 12, 27/2, 243/16, 16, 18, 81/4, 64/3, 24, 27.

Clearly, the finished result consists of the intervals of a musical scale, in the diatonic mode, encompassing four octaves and one major sixth.

Having thus subdivided the original basic strip of material, the demiurge returns, at *Timaeus* 36b7, to the more practical task of cutting up the strips and joining them together to construct a representation of the universe. His first task is that of splitting the strip, complete with all its

inscribed markings, lengthways into two strips. He then bends them into circles, fixes them centre to centre and produces two concentric circles joined in the shape of an X (36b6–c8). The two strips are then made to move in opposite directions.

The account of the next operation is very sketchy, perhaps because it is a simple description of the practical task of cutting some lengths off the circle of the Other in order to construct the planetary circles. These cutting lines will not be visible after the cutting operation and therefore do not appear to deserve the same theoretical treatment as the harmonic subdivision. The text simply tells us that the demiurge 'splits the inner circle into seven unequal circles' (36d2–3).

The structure of the Platonic universe requires seven circles on which to place the seven planets.[17] The sequence 1 to 27 is primarily concerned with the practical operation of defining the lengths of the seven planetary circumferences which will regulate the distances of the planets from the centre of the sphere. The seven numbers of the sequence, forming as they do a geometrical progression based on plane and cubic number, stand in geometric sequence. Plato, however, does not provide the details of the supposed relationship of the circumferences to the diameters of the planetary circles.[18] It is very probable that Plato was at least able to approximate the values of the diameters of the seven circles, and therefore to determine their relative distances. Furthermore, if we can assume that he was using an armillary sphere to describe the construction of the universe as created by the demiurge, then the need to determine these distances would have been immediately apparent, as it would be to any craftsman intent on constructing the model.

A table of the respective diameters of the planetary circles can help us visualize the relative distances of the planets. This representation also supports the claim at 36d2–8 that, of the seven planets, three (Sun, Venus and Mercury) move at similar speeds to each other, while four differ both from each other and from the other three.

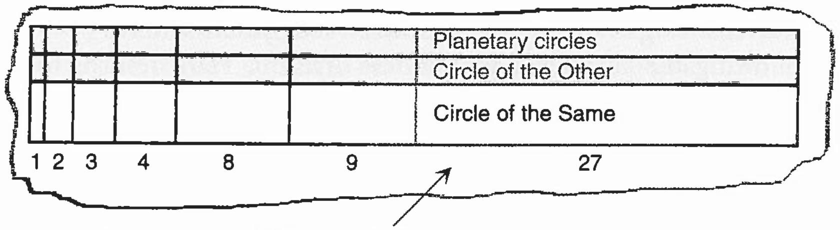
Planet	Circumference	Diameter	Difference in diameter *relative to smaller circle*
Saturn	27	8.595	5.730
Jupiter	9	2.865	0.319
Mars	8	2.546	1.188
Mercury	*4*	*1.273*	*0.318*
Venus	*3*	*0.955*	*0.319*
Sun	*2*	*0.636*	*0.318*
Moon	1	0.318	0.318
Earth		0	

The allocation of the first four circles to specific planets is explicitly mentioned at *Timaeus* 38c–e, while the relative positions of the remaining three (Mars, Jupiter and Saturn) can be derived from the description of the planetary movements in the Myth of Er at *Republic* 617b. The text gives very little detail of the allocation of the celestial bodies to the circles of world soul, and is especially reticent on such counts as relative speeds and distances.[19] It is fairly clear that the overall approach to the subdivision of the world soul strip into planetary circles is based more on empirical observation than on theoretical mathematics.[20] Thus the Moon is placed on the circle closest to the Earth on account of its speed, and its cosmic function is then given as that of demarcating the month. The next celestial body to complete the circuit, the Sun, is placed on the next circle on account of its radiance, and because it looks visually smaller than the Moon, but greater than the two planets (Venus and Mercury) who travel at the same radial speed and therefore complete their revolution in the same time.[21] While the allocation of the remaining three planets (Mars, Jupiter and Saturn) is clearly based on their relative speeds,[22] that of the first four can be ascribed to the need to construct a model of the universe that represents the visible 'as seen', i.e., taking into account such factors as the appearance of the planets (Sun and Moon) and easily observable phenomena, such as the vicinity of Mercury and Venus to the orbit of the Sun.

There is a tension throughout the description of the operation between those actions that are purely abstract, like the subdivision of the strip into intervals, and these operations which represent a necessary part of the building process. Thus the process of drawing the horizontal lines demarcating the circle of the Same and the circle of the Other is not even described, nor is the practical process of the cutting of the planetary circles. The tension seems to focus on the difference between those lines which are visible in the finished structure, the harmonic intervals delimiting the musical scale, and the marking lines needed for the operation of cutting. Thus while the latter disappear both from the account and from the finished structure, the intervals will remain as a testimonial of the mathematical genesis of the cosmos. We are drawn to assume, but the text is again reticent on this point, that the intervals can be used in some way to mark the passage of time on the moving structure of the world soul.

The difference of approach between these ostensibly similar 'marking out' operations is summarized in the text where, in the first part of the construction of the world soul, the demiurge 'divides into portions' (διένειμεν) the entire strip of world soul stuff. The second part of

the operation involves 'filling in' (ξυνεπληροῦτο) the intervals formed between the numbers defined in the first phase of the operation. There is a methodological difference between the two actions: as the verb διένειμεν indicates, the process of first subdivision of the strip of world soul is a mechanical one, involving the creation of the two strips of the Same and the Other (or Difference). It would also seem necessary, at this point, to mark on the circle of the Other the seven planetary circles which will be cut off from it at a later stage. This operation is not described in the text, but, unless the strip of the Other had been prepared for cutting before the joining process, it would be practically impossible to obtain regular strips from the cutting of a circular band of copper. A possible representation of this 'hidden' practical and necessary operation would probably look similar to the diagram below:



Remaining stuff from which the human souls will be made

III. Seeing the world soul

At the same time as providing an account of a series of practical operations which lead to the construction of a visible and tangible object, Plato is also guiding the reader through the abstract steps used by a geometer to describe the progressive subdivision of a regular plane figure. This attempt to provide, at the same time, an account of the practical operation of cutting strips of copper and of the abstract geometrical operation of 'thinking' lines on a rectangle generates internal tensions and leads to a textual inconsistency. At the end of the account of the creation of the world soul, following the passage detailing the mathematical subdivision, and previous to the account of the construction of the planetary circles, Plato tells us at *Timaeus* 36b6–7 that:

> By this time the mixture, from which he [the demiurge] had been cutting off these portions, was all used up (καὶ δὴ καὶ τὸ μειχθέν, ἐξ οὗ ταῦτα κατέτεμνεν, οὕτως ἤδη πᾶν κατανηλώκει).

However, when Plato has to account for the generation of the human soul, which for epistemological and ontological reasons needs to be composed of the same substance as the world soul, he tells us that the demiurge

melts down, in the same crucible which he has used previously, some left-over 'stuff' from the operation of cutting and pasting the intervals of the circles of the world soul.[23]

These two contradictory accounts are representative of two different ways of thinking. In the first passage, the operation described is one of abstraction: Plato is here in the middle of a geometrical operation, which can be defined as 'practical' only in the sense that he was drawing either numbers or more probably lines on a flat surface.[24] Clearly, the possibility that at the end of a geometrical operation there could be any material substance left behind is paradoxical, and Plato, in his account, tells us that the 'mixture' was all used up, in the sense that there remains no spaces unaccounted for within the theoretical rectangle of the representation of the world soul. In the next phase of the subdivision Plato will 'fill up' the intervals, in the sense that he will impose a further set of mathematical intervals resulting in the full musical scale I have just described.

Following the abstract mathematical division, Plato returns to the account of the physical and practical building of the world soul. Again, the operation can be seen as described on two levels. On the one hand the demiurge creates the circles and movements in the universe, an operation involving a detailed mathematical analysis of the proportional relationships between the various elements of the cosmos. On the other hand we can follow the operation of the craftsman in marking out, cutting and then joining together strips of metal to form an object which, as Plato tells us at *Timaeus* 40c–d, is a necessary aid to our understanding of the movements in the universe. It is at this point that we find the pieces of leftover world soul stuff (τὰ τῶν πρόσθεν ὑπόλοιπα κατεχεῖτο 41d7). Now, a human artisan, involved in making the object (the armillary sphere), would have started with an irregularly shaped sheet of metal, from which he would have cut rectangular strips. This operation would then produce offcuts of metal, irregularly shaped, but valuable enough to be smelted again, even allowing for the fact that a second process of alloying might result in the loss of some of the original properties of the metal.

The disappearance of the 'offcuts' of world soul stuff at the end of the account of mathematical subdivision raises serious questions of methodological consistency. While it is true, as Plato warns us repeatedly, that we should not expect full accuracy in an account which can only ever be a 'likely story', or at best a 'probable account', the rather impressionistic description of important operations remains difficult to explain away by simply claiming 'probability'. The problem, as I see it, is that, throughout the account of the *Timaeus*, there appear two separate and contradictory modes of thought, the theoretical and the practical, which

cannot be reconciled without forcing on the text inconsistencies of the type highlighted above.

One important implication of the problem of describing a practical process, and then a practical object, is that it is impossible to do so without at least some recourse to the process of 'picturing' the object. This can be a mental process, but Plato in the *Timaeus* appears to recognize the difficulty inherent in constructing a mental picture of the complex movements and mathematical divisions of the circles of the world soul. The solution which he explicitly proposes in order to resolve this descriptive problem is that of using an armillary sphere (or orrery) as an aid to comprehending the complex shape and movements of the universe.

That Plato probably had in front of him, as he was writing this passage, a real armillary sphere is highly probable. A further argument to the effect that Plato was, in the passage *Tim.* 35c–40e, describing a real object as opposed to constructing an abstract three-dimensional geometrical figure, is that Plato tells us (at 36c5) that the two bands eventually forming the circles of the Same and the Different are fastened one inside the other, thus creating an inner and an outer circle (καὶ τὸν μὲν ἔξω, τὸν δ' ἐντὸς ἐποιεῖτο τῶν κύκλων). In a purely theoretical model, this would be unnecessary, for in abstract geometry a plane figure has no depth, and therefore two plane figures can be superimposed without creating a three-dimensional figure.[25] The description of the world soul, however, presents in the same object both types of reasoning. The main structure of the world soul is a physical object, and is therefore subject to such rules as would apply to an artefact constructed of strips of metal. Its mathematical subdivision, however, is an example of abstract reasoning. Thus on the practical level we find the demiurge quite oblivious to the problems of accounting for the geometrical difficulties involved in constructing two identical circles which are then placed one inside the other. The difficulty here is that two such circles would not be identical for either (a) the inner circle would have to be compressed at the two points of contact with the outer one, thus forming an ellipse, or (b) the inner circle would be of a smaller diameter to allow for the thickness of the outer one.

On the second level, the account of a practical operation, that of 'cutting and pasting' the intervals inscribed on the circles of the world soul, is handled in the language of abstract geometry; although described as 'cut' (ἀποτέμνων) and 'placed on' (τιθείς), the intervals do not increase the thickness of the strip on which they are added.[26] Of course, Plato is aware of the language difficulty encountered by the theoretical mathematician in describing certain operations. We see this problem explicitly addressed, for example, at *Republic* 527a6–b1, where Plato says that the geometer is

compelled to use a language which is not, strictly speaking, appropriate to the task:

> For they speak as men of business, as though all their demonstrations had a practical aim, with their talk of squaring and applying and adding, and so on. But surely the whole study is carried on for the sake of knowledge.[27]

As I have indicated at the outset of this section, in the *Timaeus* the difficulty seems to be more than just one of language. There is a main methodological difference between the formation of the planetary circles and the inscription on these circles of the musical intervals: while the second part of the subdivision attempts to construct a purely theoretical structure by inscribing 'invisible' harmonic and geometric ratios on the circles, the first operation, the allocation of the relative distances and movements of the planets, appears to be based mainly on observation. Interestingly, this is in part the observation of the celestial motions themselves, and in part the observation of the physical model, the armillary sphere.[28]

As in the operations of melting and cutting, again we see Plato concerned with two aspects of the description of the universe. On the one hand there is the need to provide a strong mathematical framework, on which the actual movements of the stars can be firmly placed and analysed. This Plato achieves, in the first phase of subdivision, by following the methodology highlighted at *Timaeus* 31b–32c, which involved constructing a geometrical proportion, and assigning the values thus obtained to the planetary circumferences. This same process will then provide the methodology leading to the 'filling in' of intervals in the second phase of the subdivision.

On the other hand, however, there remains the problem of providing the reader with a 'mind-picturable' model, representing both the movements of the stars and planets and the non-visible paths which these bodies take. One additional difficulty in this second task is that of Plato's inability, stemming from his own acknowledged ignorance, to provide even a tentative account of the movements of some of the celestial bodies, including Mars, Jupiter and Saturn. This is particularly evident in the admission, at 39c6–9, that:

> The periods of the rest have not been observed by men, save for few; and they have no names for them, nor do they measure one against another by numerical reckoning.

In the practical task of constructing the physical model of the universe, however, Plato is not deterred by such limitations. Indeed he seems unaware that the description he is providing wavers between the physical object in front of his eyes and the abstract model of the cosmos. This

uncertainty is compounded by the fact that the armillary sphere can only be a 'probable account' of the universe. Its purpose is to aid, but not to replace, direct study of the mathematical ratios underlying it. As such, its contribution to the furthering of our knowledge of the world, and especially of the visible world, stands to reality in the same analogical relationship as any other account of both the visible and the non-visible world. The relationships remains linked to the principle, enunciated at *Timaeus* 29c1–4, that:

> an account of what is made in the image of that other, but is only a likeness, will itself be but likely, standing to the account of the former kind in a proportion: as reality is to becoming, so is truth to belief (ὅτιπερ πρὸς γένεσιν οὐσία, τοῦτο πρὸς πίστιν ἀλήθεια).

IV. Some likely conclusions

In this paper I have emphasized the differences between the two levels of thought. While it is true that Plato *does* seem at times unaware of the tension between the two levels, it is also obvious that he makes full use of some of the epistemic possibilities opened by forcing the reader to employ at the same time theoretical descriptions and visual representations of objects. The use of visual aids in the process of description and understanding of both theoretical and practical activities gives vision a much greater role to play in the process of understanding. The act of seeing, both seeing with the eyes and seeing with the mind (as would be the case with abstract descriptions), becomes an integral and valuable part of the process.

However, I am far from accepting some recent interpretations, foremost that of Press, who proposes that vision itself, *theōria,* should be understood as a type of knowledge.[29] Press suggests that *theōria* should be seen as the third way, the middle way between scepticism and dogmatism, and that:

> there is knowledge of a sort to be found in the dialogues, but...it is not the dogmatic sort of knowledge that has been sought by many interpreters of Plato.

I find his further suggestion, that *theōria* refers to something 'inner, immediate, comprehensive, and experiential', rather disconcerting, and more reminiscent of some 'new age' philosophy than of Platonic thought.

Perhaps a better role for vision could be that of intermediary, both in terms of intermediary process (the *act* of seeing) and in the sense of intermediary epistemological state (vision as a middle term between *epistēmē* and *doxa*). In this sense, the armillary sphere, which I have

described as the visible and tangible representation of the 'real' world soul, could be interpreted as standing as a middle term in some sort of relationship both with its model, the world soul, and with the account of the world soul as provided by Timaeus in his narrative. As such, vision, in this case a mental vision of the image of the world soul, becomes the bridge between knowledge of the world soul itself and sense perception of the armillary sphere.

It always seems surprising, and quite un-Platonic, that Timaeus should tell us, at 40c–d, that to understand the movements of the planets without a visible model of the universe is labour spent in vain, the statement implying that a visible representation of the real object is a necessary epistemic move towards the acquisition of stable information on that object. Unless we can place the armillary sphere, which we have described as a visible and tangible representation of the 'real' world soul, in an intermediate position between that which is totally real and that which is totally generated, we can only ever arrive at a disjointed reading of the text, where the textual inconsistencies described in this paper seem to contradict the commitment to a rational cosmogony which Timaeus is at such pains to reaffirm. While inconsistency and tension will always be present in a text dedicated to describing an object of becoming, there is no reason to assume that Plato was unaware of the inherent difficulty.

I am assuming, in my reading of the dialogue, that Plato intended that we should be constantly reminded of the fact that, in studying a physical object, a number of stages are necessary in generating in our minds a firm picture of the object. I am also assuming that these stages take the form of accounts, ranging in nature from the purely sensory, as in the case of the realization that the Moon is visually larger than Venus, to the fully abstract, as with the mathematically based intervals in the musical scale. Thus the armillary sphere must be seen as standing in an analogical relationship both with its model, the world soul, and with the image of the world soul constructed in the mind of the person trying to understand its workings. The physical representation of a real object is, in this case, an intermediary stage to understanding the original from which all copies are derived.

Any human account of the 'real' universe must be aware of the fact that the human mind has to rely on sense perception as a starting point towards understanding. While there can be no doubt that at some point in the process the mind has to be able to detach itself totally from the physicality of the objects it is studying, it also must learn to give the right value to the stimuli it receives. My claim, as a conclusion to this paper, is that the purpose of providing an account on multiple levels, as Timaeus

does, is to force us to place all information in a series of proportional relationships. In this sense, both the armillary sphere and the account of the world soul provided by Timaeus are intermediary terms in the proportion: ὅτιπερ πρὸς γένεσιν οὐσία, τοῦτο πρὸς πίστιν ἀλήθεια ('as being is to becoming so is truth to belief').

Acknowledgement

I would like to thank Professor Christopher Gill for his patience, support, and encouragement of my project.

Notes

[1] *Tim.* 34b3–4. All references in the text are to the *Timaeus* unless otherwise stated.

[2] I have used throughout this paper the text and translation of Cornford (1937), with the occasional small change where I felt this would improve clarity.

[3] *Tim.* 27d6–28a: τί τὸ ὂν ἀεί, γένεσιν δὲ οὐκ ἔχον, καὶ τί τὸ γιγνόμενον μὲν ἀεί, ὂν δὲ οὐδέποτε;

[4] *Tim.* 41d4–7. For a detailed textual analysis of this passage see Brisson 1994, 36–7, and Cornford 1937, 142.

[5] *Tim.* 58d6–59a9. Plato assumes the existence of two types of water: one liquid and one fusible. In the second category are all the metals, which are composed of large and uniform particles.

[6] Healy 1978, 200. Very little scholarship is available on this specific topic, and Healy remains the main source of information on ancient metalworking techniques and development.

[7] The most likely reason for the rarity of brass in the classical period was the difficulty of finding and using zinc in the alloying process. Earliest recorded finds date to the late ninth century, but there is no certain archaeological evidence for the widespread use of brass in the classical period. Its popularity in the Hellenistic and especially Roman period is well attested. See Forbes 1964, VII, 268–9.

[8] This fairly rare alloy was used mainly for coinage, as for example in the coins struck by Mytilene and Phocaia in the sixth century. Cf. Healy 1957, 32 n. 4. Healy also reproduces passages of the agreement between the two cities regarding the percentages of metals to be included in the coins.

[9] See *Tim.* 20a2–7; 29d4–7.

[10] *Tim.* 35b2–3: μοίρας ὅσας προσῆκεν διένειμεν.

[11] *Tim.* 35b4–6.

[12] *Tim.* 35c2–36a2: μετὰ δὲ ταῦτα ξυνεπληροῦτο τά τε διπλάσια καὶ τριπλάσια διαστήματα.

[13] Porphyry *On Ptolemy's Harmonics* p. 92 (DK 47B2).

[14] For a detailed exposition of the theories of proportion, see Heath 1921, 85–6.

[15] I am aware that algebraic notation was unknown to Plato. I use it purely for the sake of explaining a mathematical process to a modern interpreter, in the full awareness that Plato would have reached the same conclusion by a much more complex method of calculation.

[16] *Tim.* 36b1–7.

[17] See *Tim.* 38c2–e4.

[18] A good account of some of the theories is in the now dated, but still informative, Dreyer 1906. Most interpreters at this point seem to confuse their radii with circumferences, as for example Cornford 1937, 75. All the values provided in the text are circumferences, and Plato never explicitly mentions radial distances. Vlastos 1975, 49, n. 74, writes that Plato: 'does not state, nor does he claim to know, how much larger are the orbits and periods of Mars, Jupiter, Saturn than those of Venus, Mercury and Sun...when he insists that they all "move according to ratio" (*Tim.* 36d6–7 ἐν λόγῳ φερομένου, and cf. 39d2–7), which could only be an act of faith on his part (a deduction from their teleological function as "instruments of time" (ὄργανα χρόνων), it is quite possible that he had no figures for all these ratios'.

[19] Lack of space prevents me from providing here any more than an overview of the astronomical parts of the dialogue. Cornford 1937, 72–137 still has the best commentary on the astronomical passages, but good studies of this material can also be found in Brisson 1994 and Dreyer 1906 52–63.

[20] Cf. *Tim.* 36d6–8; 36e7–37a1; 39d3–8.

[21] *Tim.* 39c3–6: 'The month comes to be when the Moon completes her own revolution and overtakes the Sun; the year, when the Sun has gone around his own circle.'

[22] We may accept the conclusion of Heath 1921, i. 313 that the relative zodiacal periods for Mars (2 years), Jupiter (12 years) and Saturn (30 years) were not known to Plato, and that this ignorance justifies his vagueness as to the movements of the three outer planets. Considering, however, that these calculations were completed with a high degree of accuracy by the time of Eudoxus, it is probably more accurate to assume that Plato had only approximations to the actual times, and therefore did not commit to writing information which could be easily contradicted.

[23] *Tim.* 41d4–7. See the diagram on p. 33.

[24] Cf. *Meno*, 82b–85d.

[25] *Tim.* 36b7–c5. On this point see Cornford 1937, 74.

[26] *Tim.* 35c1–36a3.

[27] *Rep.* 527a6–b1 (trans. Lindsey).

[28] Cf. *Rep.* 530b on not looking up in the study of astronomy.

[29] Press 1995, 71.

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3

HOW TO BUILD A HUMAN BODY: AN IDEALIST'S GUIDE

Scott Burgess

The *Timaeus* contains Plato's great cosmological myth, which provides a complete account of the formation of the living universe, the creatures (mortal and immortal) that are due to inhabit it and the nature of the matter from which it is to be composed. The visible world is the finest copy of the intelligible wrought by a maker who is most good. Indeed, his benevolence is the very cause of this world's coming to be:

> He was good, and one who is good can never become jealous of anything. And so, being free of jealousy, he wanted everything to become as much like himself as possible.[1]

With this purpose in mind the demiurge (the divine craftsman) proceeds with the task of creation by reducing the chaotic motions of the primordial mass to order, and then engenders rationality by implanting the body of the world with a reasoning soul. The result is 'a living creature endowed with soul and reason through the providence of god' (*Tim.* 30b).

The narrative describes first the structure of the world body, and then that of the world soul. Plato's description of the body rests upon his geometrical theory of matter – that all perceived entities are ultimately derived from two types of right-angled triangle. These combine to form the surfaces of the four regular polyhedra, which correspond to the four traditional elements of fire, earth, air and water, but are themselves mere copies of their paradigmatic Forms. Having been thus constructed, the body is shaped into a sphere and set to rotate upon itself.

For the construction of the soul the demiurge mixes and blends together the Being that is of the intelligible realm with the Becoming that is of the sensible, in order to derive 'a third form of Being composed of both'. He then repeats this process for Sameness and Difference until he has made both intermediate Sameness and intermediate Difference. These three intermediate forms are then blended into a unity to make the final mixture of world soul. The meaning of this account is most readily understood by

reference to the cognitive functioning of soul. If soul is to be able to relate to and know any object, whether sensible or intelligible, it must, according to the cognitive principle that like is known by like, contain these within it. Such is the meaning given by Proclus in his commentary:

> Since the soul consists of three parts, Sameness, Difference and Existence in a form intermediate between the indivisible and the...divisible, by means of this she knows both orders of things, for all knowledge is accomplished by means of a likeness between the knower and the known.[2]

After the account of world body and world soul, Timaeus proceeds in reverse order to explain the construction of human soul and human body. Once the immortal human soul is formed, from the same mixture as the world soul and so a microcosm of it,[3] the demiurge then hands over to the first generation of created gods the task of devising a body suitable for both the conveyance and protection of soul. These lesser gods set about the task of constructing the human body on the physical principles employed for the construction of the world body:

> In imitation of their own maker [i.e. the demiurge who had constructed the world body], they borrowed portions of fire and earth and air and water from the world – on condition that these loans should be repaid – and welded them together, making each separate body out of the four elements.[4]

In the subsequent details Timaeus relates how the gods first formed the substance of the marrow (*muelos*), shaping it, in imitation of the body of the world, into a sphere, inserting therein the circuits of the immortal soul and rounding it with protective bone. The marrow is further divided into strips, the most prominent being the spinal marrow, and these are likewise encased by bone; the structure of the body is then built outwards from this point and around the marrow. Flesh is formed to protect bone both as a cushioning pad and as a means of regulating extremes of temperature, while the sinews provide elasticity and bind the frame together. The body is then completed at its extremity by the formation of skin, hair and nails.

On the relation of man to the cosmos, commentators on the *Timaeus* are generally agreed that world soul relates to human soul, because of their common substance and design, and world body to human body, since all visible objects are constructed from the same physical elements. The result of this interpretation of the principle of the microcosm reflecting the macrocosm is to separate the account of the nature of man given in the *Timaeus* into two sets of parallel constructions – the psychological and the physiological. The human soul has then been understood by internal reference to the world soul, and so is related to the central

themes of the narrative, but the detailed design of the human body has been referred to external sources and as such dismissed as unoriginal and unimportant.[5] The consequence of first separating the psychological from the physiological in this way and then of viewing the latter as entirely derivative is ultimately to separate the account of the human body from the main issues of the *Timaeus*. Plato is seen as merely 'giving us what he believes to be a summary of the best available knowledge about these subjects'.[6]

More recent scholarship has drawn a closer association between these two constructions, especially in terms of Plato's use of the concept of teleology,[7] but it will be suggested here that a direct link may be made between the design of soul and body in the account of the sinews and their relation to bone and flesh. This paper therefore concentrates on one particular aspect of the human construction, namely the role and function of the sinews within the body, and sets out to show their relevance to the main theories of cosmic harmony and the relation of macrocosm to microcosm which are basic to the myth of creation. After discussing the significance of the sinews for the functioning of the body, we shall conclude by positing a direct link between sinews and the soul, both in terms of the qualities of their composite elements and on the point of a shared design. It will be argued that, in constructing the sinews as a triadic formation, Plato's aim was not so much to convey anatomical detail[8] as to demonstrate philosophical theory. The purpose of this analysis of sinews, then, will be to relate the body to the internal themes of the *Timaeus* rather than to external sources, in order to see Plato's biology as an integral part of the cosmic system here presented.

The narrator describes the sinews according to their function and composition, starting with the former (*Tim.* 74b):

> [The god] bound all the limbs together with sinews that could contract and relax, and so enabled the body to flex about the pivots and stretch itself out.

The primacy of sinews in this physical account is clearly attested by the assertions (a) that they are responsible for the cohesion of the human frame (ἅπαντα τὰ μέλη συνδήσας), and (b) that they are the physical cause of movement (καμπτόμενον τὸ σῶμα καὶ ἐκτεινόμενον) – a purposive motion that is achieved through the reconciliation of the bodily opposites of bone and flesh. They may thus be said to keep the body at the particular pitch or tension that is necessary for its operation.

With regard to terminology, the character and significance of the sinews is obscured by the ambiguity of the term *neuron*, which came to denote

a number of objects, as explained by Salazar:

> The word *neuron* is a particularly striking example of a wide range of references attached to a single word. We find it used of sinews and tendons, nerves and even veins...yet if one takes into account the non-anatomical uses of the word – cord, bow-string, string of a lyre, plant fibres – there seems to be one common element of 'stringiness' that makes it possible to use it for those different objects.[9]

The nature of sinews may, therefore, be illuminated by reference to this 'stringiness' and also to the originally ambiguous Homeric form of ἡ νεῦρη, a feminine noun – unlike the Platonic neuter – which can be taken as either 'string or cord of sinew' or 'bowstring'. Plato's use of this term (and he was surely aware of the inherent ambiguities) suggests that we are to understand the sinew as sharing the attributes of a bowstring. Now the correct functioning of the bow is ensured by an exact tension, clearly displayed in the recurrent Homeric images of 'back-stretching' bows, which is provided by the string between its component parts – if it is too slack, the bow does not pull, and if too tight the string snaps. And this notion of a vital tension is clearly applicable to the functioning of the anatomical sinew, which stretches the body to a precise tension. We may also note Aristotle's view of the cause of the weakness of joints and sinews in both the young and the old, as this provides a clear illustration of a theory of the sinews as being responsible for holding the body in a precise and necessary tension:

> Those in the prime of life [i.e. the intermediate age] are stronger... In the young [the sinews] are not yet tense, and in those now growing old the tension relaxes; that is why both these ages are weak and powerless for movement.[10]

Since the state of this tension is a precise one, akin to that of a bow, it is also clear that if the sinew is stretched beyond the extreme point of elasticity, it will suddenly and inevitably snap. This is first represented in the Homeric battle scenes, where we hear of a heavy blow which is said to have 'snapped the tendons strung to the skull's base'. In addition, and as in the case of the cut bowstring, the damage is understood as irreversible. The irrevocable nature of such an injury is evident in Aristotle's pronouncement that 'if sinews are cut asunder, the severed parts will not again cohere'.[11]

The theme of the danger of damage to the sinews is found in many Hippocratic texts, for example in *Diseases*, where the insistence on the failure of a severed sinew to reunite is similar to Aristotle's report of the serious nature of the injury. Elsewhere it is implied that excesses

of temperature are damaging to sinews, and therefore that their nature benefits from moderation between extremes.[12] A similar theory, applied to treatment, is to be found in *Use of Liquids* where, with regard to the therapies of taking hot or cold water, the physician warns: 'But stop before any excess, each of these does damage', since the sinews will be harmed both by the excessively cold (which is said to induce convulsion) and by the use of too much hot water (which leads to a softening, and so incapacitation, of the sinews).[13]

The image that emerges from the above sources (resulting from the bowstring analogy) is of the physiological *neura* as a 'tensioned' substance which (a) is itself harmonious, (b) is the cause of harmony between the bodily opposites of bone and flesh, and (c) may be destroyed by extreme conditions (such as excessive temperatures).

With these attributes in mind, it is relevant to compare a passage from the *Hippolytus*, in which the physical language of sinews has been transposed by Euripides from a physiological context to an erotic one. Here it is the *phrenes* that are referred to as a tensioned entity that must not be stretched beyond the extreme point of elasticity. The nurse is speaking of the need to moderate emotion:

> The affection that binds hearts (*phrenes*) should be easy to loosen, easy either to cast aside or to draw tightly to them.

In order to function correctly the *phrenes* must have the correct amount of flexure, otherwise they will snap (as with an over-tightened lyre string), and then death follows – as the nurse warns, 'an unswerving life leads to a fall'.[14]

If these physical attributes were deemed appropriate to an erotic context it also seems possible to apply them to a psychological one, i.e. the theory of soul as a harmony. The main example occurs in the objection put forward by Simmias in Plato's *Phaedo*. Within the context of this dialogue Simmias states his theory as a criticism of the third Socratic proof of immortality (the argument based on the affinity of soul to the Forms, from 78b–84b) and its theme is as follows:

> Our body is kept in tension (ἐντεταμένου τοῦ σώματος) and held together by hot and cold, dry and wet and the like, and our soul is a blending and attunement (κρᾶσις καὶ ἁρμονία) of these same things when they are mixed with each other in due proportion.

This vocabulary recurs in the *Timaeus* in the opposition between the bodily extremes of rigid brittle bone and pliant yielding flesh: as the soul is composed of the powers whose action it mediates, so too are the

sinews a blending of bone and flesh. The principle is similar to that in the *Phaedo* since both sinews and the soul perform their designated functions through the reconciliation of opposites – the sinews enabling movement and the soul life. Furthermore, Simmias concludes that if his thesis is correct:

> It is clear that when our body is unduly relaxed or tautened by illnesses and other troubles then the soul must perish at once.[15]

This manner of death, by relaxing or tightening, is wholly in accord with the means by which both bowstrings and sinews malfunction.

The sinews (in the *Timaeus*) maintain a balance between extremes and so enable activity, since, if they were not present to balance the natural tendencies of bone and flesh, the body would be reduced to either a rigid board or a shapeless and undistinguished mass. In this function they are analogous to the place occupied by soul in harmonic theory. The suggestion put forward here then is that Plato may have been drawing on an existing concept of the soul and assimilating it to his own account of the human nature of man, but with the intention of transposing (or even relegating) it to a purely physiological and mechanical sense.

Three main points may be selected from the Socratic criticism of psychic attunement given in the *Phaedo*, since they provide an incidental account of the essential nature of an attunement that can be directly applied to our anatomical setting: (a) it is obviously impossible for an attunement to exist before the elements of which it is to be composed (92b), (b) an attunement cannot act or indeed exist in any state other than that derived from the elements of which it is composed (93a), and (c) an essential characteristic of an attunement *qua* attunement is homogeneity, i.e. 'no one attunement is either more, to a greater extent, or less, to a lesser extent, of an attunement than any other' (93d). When these characteristics are applied to the physiology of the *Timaeus* (a) is an obvious truism of sinew, which is portrayed as third to bone and flesh in the order of generation, (b) is no less true, since in action the sinew is limited to the states of bone-like tension or flesh-like relaxation, and (c) is equally applicable to the uniformity of all fully functioning sinews.

Returning to a direct point of anatomical detail, we have seen that Plato, at *Timaeus* 74b, treated the *neura* as being responsible for both bodily cohesion and movement (via tension and relaxation). Throughout this section of his account he neither mentions muscle (the usual, if not always accurate, translation of *mus*) nor distinguishes one sinew/tendon/ligament word from another, although terms other than *neur-* derivatives were available. The physical frame in the *Timaeus* is said to be composed simply

of two extremes (bone and flesh) and a third single and undifferentiated intermediate, *neura*. This omission of muscle may be taken in one of two ways: either Plato was unaware of distinctions between muscle and sinew or he had a reason for not making use of them. Ignorance is unlikely since distinctions between *mus* and *neura* were already being drawn in the *Iliad*. Although Homeric anatomical terminology was mainly concerned with the naming of certain thick or prominent structures, we may still see in Homer the use of different words to describe the sinews in addition to the notice of bodily parts, and so conclude that some form of anatomical differentiation was being suggested. An example may be taken from book 16 of the *Iliad*:

> And the son of Phyleus, as he watched Amphiclus that was rushing upon him, proved quicker than his foe, and smote him upon the base of the leg, where a man's muscle (μυών) is thickest; and round about the spear-point the sinews (νεῦρα) were rent apart; and darkness enfolded his eyes.

It is apparent in this quotation that two separate, and separately named, tissues are being spoken of in the articulation of the thigh, i.e. that the terms *mus* and *neura* relate to separate objects. There is a similar distinction in the description of the neck cords, also from *Iliad* 16:

> Now [Patroclus] smote Sthenelaus, the dear son of Ithaemenes, upon the neck with a stone, and broke away the sinews (τένοντας) from it.[16]

The terminological distinctions mentioned above concerning these tissues (i.e. the muscle and the tendon/sinew terms – *mus*, *neura*, *tenōn*, *tonoi*) are represented with greater clarity in the increasingly specialised medical context of the Hippocratic surgical treatises (*On Fractures*, *On Joints* and *Instruments of Reduction*). An example, which mentions and distinguishes between flesh, bone, *mus* and *tenōn*, is the hypothetical account of the dissection of the shoulder given in *On Joints*:

> Suppose one laid bare the point of the shoulder of the fleshy parts from the arm and also denuded it at the part where the muscle (ὁ μῦς) is attached and laid bare the sinew (τὸν τένοντα) stretching along the armpit and collarbone to the chest...

Such texts provide us with examples of a clear and consistent distinction between *mus* (identifying the biceps) as thickly bunched flesh, and *neura* as elastic cords. They can be credited with both the identification of specific named muscles (such as the biceps) and with the use of a more precise terminology to describe them, as at *On Joints* 30 where the terms 'temporals' and 'chewers' are used to describe the two sets of muscles attached to the jaw. We may likewise note both the recognition of general

and specific named sinews (such as the Achilles tendon), and the attempt to subdivide the sinews according to their varying characteristics made by the author of *Instruments of Reduction*, who distinguishes between *neura* that are 'mobile and in moist parts' and 'yielding' and those which are less so. We therefore have (a) a distinction between muscle/*mus* and the sinew terms of *neura*/*tonos*/*tenōn*, and (b) subdivisions in these classes to differentiate between specific, individual structures.[17]

These Homeric and Hippocratic sources demonstrate that anatomical knowledge of a more detailed (if not generally accepted) nature was available to Plato, and this is supported by the fact that in his account of diseases Plato himself uses both *neura* and *epitonos* in the same sentence (*Timaeus* 84c8). The main exception is the Hippocratic treatise *Places in Man*, which ascribes muscular activity to the *neura*, and makes no use of the term *mus*. This is significant for Plato who, with the various distinctions outlined above in Homer and other Hippocratic passages available to him, intentionally took *neura* as a mass noun because, if he had viewed the sinews as a subdivided group, the anatomical detail would have robbed his account of its fine philosophical symmetry. Instead he is able to set up the sinews as a single intermediate set between extremes and so force this feature to conform to the principal of triadic formations (the system of two extremes and a third blended intermediate) that is dominant in the psychology of the world soul and the human soul in the *Timaeus*. Plato is not so much relaying the empirical researches of other anatomists[18] as constructing the body as a part of the cosmos according to certain reasoned principles. The position is summarized by Metraux:

> They [Empedocles, Plato, Aristotle] saw divine origins and universal laws of motion and causation in their observations, facts and notions about the body. This eagerness to 'see through' the body to universal principles is part of a philosopher's tendency to create a teleology of the body, in which all aspects of anatomy and physiology are relatable to other, higher and more primordial causes. The most elevated expression of this teleology, admittedly presented as probable rather than actual, is the anatomy and physiology of the *Timaeus*.[19]

In addition, along with the composition of sinews, there is further evidence of a triadic theory in the demiurge's use of colour (*Tim.* 74d):

> And the substance of the sinews (τῶν νεύρων) he compounded of a mixture of bone and unfermented flesh, forming a single substance blended of both and intermediate in quality, and he used yellow also for its colouring.

This description is flatly dismissed by some as inadequate, on the grounds that the notion of sinews as a blended entity does not account for, but

merely alludes to, their nature. Longrigg and Solmsen both take this line. They view Plato's account as biologically imprecise because, although in an earlier section he analysed both bone and flesh in terms of their constituent elements, he gave no such analysis of sinews.[20]

Now whereas it is certainly correct to view the *neura* as being a 'secondary' formation composed of the four elements, and not a 'tertiary' one in the Aristotelian sense, we may justifiably ask why they are represented as third after the generation of bone and flesh. Taylor suggests that the sinews are intermediate by virtue of the fact that they derive nourishment from both bone and flesh.[21] While this point may plausibly account for the perpetuation of their blended form it cannot be used to explain the initial impetus – why they have been so designed. A far more interesting suggestion is made by Joubaud, who states that Plato has viewed the body in terms of two extremes and an intermediate in order to offer a logical analysis of movement.[22] Yet I would like to suggest that Plato's main purpose here is the demonstration of a philosophical theory, namely the application of metaphysical triadic concepts to the body.

In general, commentators have been concerned with the reiteration of the point that *neuron* does indeed refer to sinew and not to a proto-nervous system,[23] and are united in comparing this to a similarly framed Hippocratic account which also takes *neura* as an intermediate formation:

> Sinews (νεῦρα) are in colour and strength midway between bone and flesh; they are moister than bone and more fleshy, but drier than flesh and more osseous.[24]

A possible difference, however, that has received no further comment or explanation is the colour. The Hippocratic sinew would, presumably, be pink (since it is red flesh combined with bleached white bone), whereas for the corresponding Platonic feature the creator added a yellow colour (ξανθῷ χρώματι προσχρώμενος, 74d). Yellow here would not seem to be an obvious hybrid of white and red, but may be explained by a cross reference back to the account of vision where it is stated that 'bright' colour when blended with red and white becomes 'yellow' (ξανθόν, 68b). With this reference in mind it would seem that we should take the yellow colour as an allusion that reinforces the image of sinew as a blended entity – a visible display of its intermediate nature. It may well be that Plato is disagreeing with the Hippocratic position in order to stay consistent with himself.[25]

Once the sinews, as an intermediate construction, have been artificially (in the physiological sense) contained within triadic theory, we may begin to draw an analogy between sinews and the soul. We are given the

demiurge's method (*Tim.* 35a):

> Between the being that is indivisible and always changeless, and the one that is divisible and comes to be in the corporeal realm, he mixed a third intermediate form of being, derived from the other two.

These two opposites correspond in the body to bone, the 'inflexible', and flesh, 'full of sap'. Now in spite of these points it is clearly not possible to draw a precise parallel between immutable, eternal Being and bone (even if bone had been called 'indestructible' by Socrates at *Phaedo* 80c). Nevertheless the suggestion may be made, because both sinews (between bone and flesh) and the soul (between being and becoming) belong with triadic forms, and also because their components have similar characteristics; the presence of marrow in bone implies, as we shall show, an association with the eternal realm, whereas the substance of flesh has the opposite connotation.

The analogy may be completed by the inclusion of the circles of the Same and the Other. These are the faculties by which the mind may make contact with either of the epistemologically defined spheres (being or becoming) through the process of approximation to the nature of that sphere. The point relevant for this analogy is the nature of the psychic Same and Other and the reason for their presence in the soul. If the soul is to be able to relate to and know any objects, whether sensible or intelligible, it must, according to the cognitive principle that like is known by like, contain these within it. It is for this reason that these abstractions are portrayed as material substances, so that Plato may put them into the hands of the demiurge for the formation of the soul. Thus, though they are derived from and relate to 'substances' (the Forms and the physical), they are themselves more akin to 'powers', and are responsible for the faculty of mind rather than its matter, since it is by Being that the soul is said to be. The circle of the Same is that aspect of the mind which deals with the fixed Forms, and is epistemologically defined (at *Tim.* 37a–c) in terms of its intelligible object; when the mind uses the circle of the Same it is therefore using the faculty of intelligence. Similarly the activity of the sinews, when they are tensed, approximates to the rigidity of bone (the physical 'fixed' or same) by the use of their faculty of tension. The faculty of Otherness in the soul is used to contact (to perceive rather than to apprehend) the unfixed, or moving physical, through its ability to approximate to the epistemological qualities of the physical by the use of the non-rational faculty of opinion.[26] So too may the appropriate aspect of the sinew approximate to the unfixed fluidity of flesh through relaxation.

After noting the obviously opposite tactile qualities of bone and flesh, we may now begin to strengthen their opposition (and so strengthen our analogy) by an extension of Brisson's analysis of the position of marrow (*muelos*) within the body. We saw earlier that according to Plato's theory all sensible objects, including the body, are composed from the two types of right-angled triangle that form the surfaces of the four regular polyhedra corresponding to the four familiar elements of fire, air, water and earth. In the account of marrow, however, we further learn that these geometrical 'atoms' may not be of a uniform quality. Marrow is introduced as prior to, and separate from, bone and flesh as follows:

> The god isolated from their respective kinds those primary triangles which were undistorted and smooth, and hence, owing to their exactness, were particularly well suited to make up fire, water, air and earth. He mixed them together in the right proportions, and from them made the marrow, a 'universal seed' (πανσπερμία) contrived for every mortal kind (73b–c).

Brisson takes this account of the composition of marrow as a starting point to set up a relationship of opposites within the body by making a contrast between the tissues in terms of the varying quality of the material out of which they are constructed. We may follow his interpretation:

> For the generation of the two fundamental components of the body, marrow and flesh, the demiurge uses right-angled triangles of two different qualities. On the one hand marrow, a substance in which soul comes to anchor itself, is made up of smooth and unwarped triangles; on the other hand flesh, a substance that corresponds to the corruptible, is made up of ordinary triangles.[27]

The opposition that Brisson finds between marrow and flesh (in terms of the purity of the sub-elemental triangles of which they are composed) suggests that the latter is to be associated more with the 'corruptible' sensible world and so the former would be related to the eternal and intelligible world. This may be extended and taken to introduce a similar antithetical relationship between bone and flesh, for, if marrow is different from flesh, and bone is partly composed of marrow, then bone to this extent is different from flesh. The point is that if the presence of marrow in bone suggests an association with the eternal then its absence from flesh suggests a complementary association with the phenomenal.

The process of blending that has been performed by the creators is not comparable to the mixing of yellow and blue to form a static green, but produces a mixed entity that retains the characters of, and is able to use selectively, the opposite elements of which it has been composed.[28] In the present case the opposite elements are bone and flesh. And here

a quotation from Aristotle may be taken as an illustration of the sinews' retaining the antithetical characteristics of the elements from which they were composed, namely tough bone and soft flesh:

> Sinew is fissile lengthways but crosswise it is not easily broken, but admits of a considerable amount of hard tension.[29]

The purpose of drawing this analogy is to link the parallel world constructions that Plato has described in the *Timaeus* in terms of the two-tier (psychological and physiological) construction of humans, and to suggest that they have been so linked by the portrayal of *neura* as a triadic formation. And so, whereas the usual interpretation of the principle of macro/microcosm is of world soul to human soul, this may now be widened to suggest that the reasoning evident in the construction of the soul has been reduplicated and applied to the schema of the body. The human soul may then be viewed as a middle term that links world soul to human body, for as world soul is to human soul so is human soul to human body. The crucial point is that the psychological and the physiological are constructed on related principles according to a similar triadic formation, and so suggest a parity of design between the two. The same principle of rational design has been applied to world soul, human soul and (through sinews) to human body; and the varying degrees of clarity with which these three forms illustrate their triadic paradigm should be viewed in terms of the relative purity possessed by their subject matter. The world soul is the first image of a blended form, the human soul (being made from a diluted version of the original soul) the second, and third is the human body, owing its cohesion and movement to the sinews, which reconcile its physical opposites of bone and flesh. The result of widening the scope of the usual interpretation of the macrocosm is to link human soul and human body in a manner more directly comparable to the link between world soul and human soul. This gives Plato's biology an integral place in the *Timaeus*.

The conclusions drawn above regarding the apparent continuation of a common triadic design from the world soul to the human soul and thence to the human body can also be understood as evidence of the great care with which the construction of the human body has been formulated. This is entirely consistent with two key elements of Plato's mythic narrative – the intentions of the demiurge and the necessity of human existence. We mentioned the benevolence of this creator in the introduction and can now give the place of the creatures within his cosmos:

> Three mortal kinds [destined to inhabit earth, air and water] still remain ungenerated; but if these come not into being the heaven will be imperfect, for it will not contain within itself the whole sum of the kinds of living creatures, yet contain them it must if it is to be fully perfect (*Tim.* 41b, trans. Bury).

In a created cosmos in which perfection consists in harmony and completeness no part may be neglected. If the human race is to come into being, and the demiurge is without envy, then it would be expected that all aspects of the human body would partake to the extent to which they are able in a common, reasoned design. And we may understand Plato's construction of the body in terms of two extremes and a third blended intermediate as indicating the presence of this common design, as well as being itself analogous to the human soul and an illustration of the all pervasive presence of *nous* in the cosmos.

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Notes

1 *Tim.* 29e (all translations from D.J. Zeyl unless otherwise indicated).

2 Cited by Cornford 1937, 261.

3 Cf. *Tim.* 41d: '[For the formation of human soul] he turned again to the mixing bowl he had used before, the one in which he had blended and mixed the soul of the universe. He began to pour into it what remained of the previous ingredients, and to mix them in somewhat the same manner, though these were no longer invariably and constantly pure, but of a second and third grade of purity.'

4 *Tim.* 42e, trans. Longrigg, 128.

5 Cf. Lloyd 1968, 79: 'There is the common claim that whatever natural science Plato did was, in any case, unoriginal: his account of natural phenomena and processes is an amalgam of the theories of his predecessors and contemporaries'; cf. Taylor 1928, 11: 'The teaching of Timaeus can be shown to be in detail exactly what we should expect of a fifth century Italian Pythagorean who was a medical man.'

6 Bury 1929, 14.

7 Cf. Solmsen 1968, 72: 'It is through his conception of the marrow that Plato brings the soul into his account of the tissues. The marrow has its physical components, which are the finest particles of the four elements, yet it also has its soul factors; and it is because the soul is present in brain and marrow that all other tissues have their *archē* in the marrow and are understood with reference to it (i.e. are designed teleologically, with a view to its protection); Plato has thus linked tissues and the soul.'

8 Cf. Hall 1968, 120: 'We must be careful not to see in Plato a "purer" scientist

than he actually was.'

[9] Salazar 2000,10.

[10] Aristotle, *GA* 787b10 (trans. Ogle). See also Aristotle's account of eunuchs, *GA* 787b20: 'All animals when castrated change to the female character, and utter a voice like that of females because the sinewy strength in the principle of the voice is relaxed...[for] the testes are attached to the seminal passages, and these again to the blood vessel which takes its origin in the heart near the organ which sets the voice in motion... If the testes are removed the tension of the passages relaxes, and, as this relaxes, the organ which moves the voice is loosened in the same proportion. This, then, is the reason why the voice and the form generally change to the female character in castrated animals: it is because the principle is relaxed upon which depends the tension of the body' (trans. Platt).

[11] Aristotle *HA* 515b20 (trans. Ogle). For Homer, cf. n. 16.

[12] Cf. *On generation* 2: The cut penile sinews of eunuchs are described as 'insensitive as a result of the damage...no longer able to relax or contract consciously' and *Diseases* 1.4; also *Aphorisms* 5.16: 'Heat produces the following harmful results in those who use it too frequently: softening of the flesh (σαρκῶν), impotence of the sinews (νευρῶν), dullness of the intelligence, haemorrhages and fainting, death ensuing in certain of these cases; cf. 5.18: 'Cold is harmful to bones, teeth and sinews' (translations by Lloyd 1983).

[13] *Liquids* 2 (trans. Potter).

[14] Euripides *Hipp.* 253–7, 264–6 (trans. Barrett).

[15] Plato *Phaedo* 86b–c (trans. Gallop).

[16] *Iliad* 16. 313–16, 586–7 (trans. Murray).

[17] *On Joints* 1 (trans. Withington). Cf. *On the Heart* 4: 'The heart is an exceedingly strong muscle – "muscle" in the sense not of sinew but of a compressed mass of flesh' (trans. Lloyd); Aristotle *GA* 743b10: 'Sinews [are] solid and elastic'; Hippocrates *On Fractures* 44: 'the bifurcation of the blood vessel, which passes upwards along the muscle' (μύος i.e. the biceps); *On Fractures* 11: 'The back tendon (τένων ὀπίσθιος, i.e. the Achilles tendon) is inserted into this bone'; *On Joints* 45: 'There are also certain ligamentous cords (τόνοι νευρώδεις) extending all along [the spine], attached on either side of them' (translations Withington).

[18] Lloyd 1983, *Intro*: '[Plato's] preference for reason over sensation and observation...[in his] methods of investigating natural phenomena may, I suggested, be contrasted unfavourably with those of some of his more empirical contemporaries, particularly among the medical writers. It was not Plato's way to undertake detailed empirical research in connection with his accounts of causes, and sometimes (for example in anatomy) much might have been gained had he done so. While his more provocative remarks denigrating the use of the senses should be interpreted as suggesting merely that observation is inferior to reason, and not as suggesting that observation is completely worthless, their effect was still undoubtedly to discourage empirical investigations.'

[19] Metraux 1999, 10.

[20] Cf. Longrigg 1993, 132: 'In discussing the composition of the sinews Plato

does not provide an analysis of their constituent elements, but contents himself with the remark that sinews are an intermediate substance'; Solmsen 1968, 447: 'In discussing the sinews Plato does not find it necessary to analyse them into elements but prefers to say that the "nature" of this tissue occupies a position midway between those of bone and flesh...' It is certainly correct for us to understand that sinew is made of the same elements as bone and flesh in a ratio that is intermediate between that of these two tissues. The construction of bone is given at 73e ('He sifted earth that was pure and smooth, kneaded it and soaked it with marrow. Next, he set this mixture in fire, and then dipped it in water, then back in fire, followed by water again.'); flesh at 74c ('[Our modeller] made a mixture using fire, water and earth, which he adjusted together, and created a compound of acid and brine, a fermented mixture which he combined with the previous mixture, and so he formed flesh, sappy and soft').

[21] Cf. Taylor 1928, 531: '[sinews] are nourished partly from bone and partly from flesh, with the result that they are moister and more fleshly than bone, but drier and more bony than flesh. This explains why in the order of creation Timaeus puts them after both bone and flesh.'

[22] Cf. Joubaud 1991, 59: 'Il s'agit de construire un lien pour tenir des intermédiaires en position de fonctionnment, à savoir les articulations. Les tendons sont le lien entre deux os consécutifs et fonctionant de pair. C'est pourquoi l'explication de Platon se veut rationnelle par rapport à ce mécanisme physique.'

[23] Cf. Archer-Hind 1888, 274: 'By *neura* Plato always means tendons or ligaments, not nerves, which were entirely unknown to him', and Taylor 1928, 529: 'The *neura* are not nerves but sinews and tendons.'

[24] *Places in Man* 4 (trans. Potter).

[25] *Contra* Solmsen 1968, 447–8, that the definition of sinews in Plato keeps close to and expresses his agreement with Hippocratic doctrine.

[26] Cf. *Tim.* 37b–c: '...Whenever the account concerns anything that is perceptible, the circle of the Different goes straight and proclaims it throughout its whole soul; this is how firm and true opinions and convictions come about. Whenever, on the other hand, the account concerns any object of reasoning, and the circle of the Same runs well and declares it, the necessary result is understanding and knowledge.'

[27] Cf. Brisson 1992, 57.

[28] On the blending of colours which retain their individual characteristics cf. Empedocles fr. 23 and Wright 38–39, 179–80.

[29] Aristotle *HA* 515b15 (trans. Thomson).

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4

THE BODY'S FAULT? PLATO'S *TIMAEUS* ON PSYCHIC ILLNESS

Christopher Gill

Timaeus 86b–87b is a notoriously puzzling passage, containing two striking claims. One is that psychic illness – taken to include moral and mental failings – is the outcome of bodily defectiveness. The other is that people should not be held responsible, and blamed, for these failings. A further arresting idea, developed in 87c–90d, is that psychic therapy should focus on the relationship between the body and the psyche.[1] Even what are normally seen as purely intellectual pursuits are characterized in markedly physicalist terms (90a–d).

In trying to find an explanatory framework for these claims, I refer to several larger issues. One, which is central to the concerns of this volume, is the question of the kind of relationship between psyche and body presented in the *Timaeus* as a whole. Another relates to Platonic interpretation more generally. In trying to explain claims in Platonic dialogues, how far should we focus on the internal logic of any one dialogue and how far on the treatment of a given theme, such as psychic illness, across dialogues?[2] Also, in exploring the significance of these passages in the *Timaeus*, I take account of their reception, as far as this can be recovered, within antiquity. In particular, here as elsewhere, I construct a kind of dialogue between Galenic and Stoic readings of these texts.[3] In doing so, my aim is not primarily to study these later theories, or even their reception of Plato, for their own sake. The intention is to use later ancient readings, whether explicit or reconstructed, as a basis for making the best available sense of the Platonic text.

I. *Timaeus* 86b–87b and its interpretation

First, what claims are being made about psychic illness in *Timaeus* 86b–87b and how strong are they? On this point, as well as on the larger interpretation of the passage, there is marked disagreement among commentators. Disagreement begins with the first sentence: καὶ τὰ μὲν

περὶ τὸ σῶμα νοσήματα ταύτῃ συμβαίνει γιγνόμενα, τὰ δὲ περὶ ψυχὴν διὰ σώματος ἕξιν τῇδε (86b1–2). The latter part of the sentence might mean: 'diseases of the psyche arise because of the condition of the body in the following way' or, alternatively, 'the diseases of the psyche that arise from a bodily condition come about in the following way'.[4] The first reading implies a strong claim: '*all* diseases of the psyche derive from bodily causes'; the second reading suggests a weaker claim, that *some* psychic diseases arise in this way. Taken on their own, the words allow either reading; and the following paragraphs (86c–87b), which we might expect to specify the meaning, are themselves taken in various ways by interpreters. But it seems to me that the opening statement and its expansion suggest the stronger claim.[5]

I take the opening sentence to mean: 'this is the way (ταύτῃ) that bodily illnesses occur, while psychic illnesses occur because of the condition of the body in the following way (τῇδε)'.[6] The thrust of the remainder of the section, as I read it, is to show how the various defects of the psyche, which are presented as types of disease (more specifically, of madness or ignorance) derive from bodily conditions. I see no clear indication that Timaeus is only explaining a subgroup of psychic illness, that is, those with physical causes. The categories are very general and seem designed to be comprehensive,[7] even though the passage includes certain striking examples, notably that of hypersexuality (86d).

Timaeus begins by saying that 'disease of the psyche is folly (ἄνοια), and there are two kinds of folly, namely madness (μανία) and ignorance (ἀμαθία)' (86b2–4). This might suggest a sharp distinction between types of psychic illness, but, in fact, the following discussion tends to highlight the connection between them. The thrust of the passage, I think, is to show how the different kinds of psychic defect that are generally recognized can be marshalled under the headings of 'madness' and 'ignorance' and so conceived as forms of psychic illness; and, then, to explain such illness by reference to bodily defect. Overwhelming (ὑπερβαλλούσας) pleasures and pains are cited as a clear illustration of this point: they constitute the 'greatest' diseases of the psyche (86b5–7), while also having physiological causes (86c, 86e–87a). These 'diseases' include 'raving' (λυττᾷ) and being 'at that moment least capable of reasoning' (86c2–3). These two symptoms can be taken as reflecting the two forms of psychic illness, 'madness' and 'ignorance', identified earlier. A similar combination is cited in connection with the example of hypersexuality. Someone with this condition is said to be 'maddened' (ἐμμανής) by the greatest pleasures and pains and also to have a 'sick and mindless (ἄφρονα) psyche' (86c7–d2). The physical basis for this psychic sickness is explained as 'excessive and fluid seed around

the marrow' (86c3–4), which is itself the product of a constitutional physical defect, that of having porous bones which allow free passage to bone-marrow and the seminal fluid it contains (86d3–5).[8]

A similar line of thought is developed in connection with pain. An accumulation of 'acid and briny phlegms' or 'bitter and bilious humours', if unable to find release from the body, is said to cause 'all sorts of (παντοδαπά) diseases of the psyche' (86e). Invading 'the three regions of the psyche' (that is, liver, heart, and brain), they induce various forms of disease appropriate to the relevant part of the psyche, including ill-temper (δυσκολίας), cowardice, and inability to learn (δυσμαθίας) (87a).[9] The focus seems to be on producing a comprehensive explanation for the whole range of psychological defects (understood as forms of 'illness') rather than defining that subset of such defects for which a physical explanation can be found. It is true that Timaeus closes this section by citing a second (external) cause for psychic defect, namely social influences (87b). But this factor is presented as one that either compounds the effect of bad physical 'constitutions' or fails to 'cure' these, rather than as being an independent source of psychic disease.[10]

This claim, then, seems to be both strong and unqualified, and it is coupled with another that seems equally strong and controversial. The second claim is that, since psychic failings are caused in this way, people should not be blamed for them. The failings associated with excessive pleasures and pains, such as hypersexuality, are usually regarded as voluntary (ἑκών) and as grounds for reproach (ὄνειδος), described in such terms as 'sexual self-indulgence' (86d). But, in fact, a person with such a failing is not willingly bad but 'sick' (νοσῶν). Indeed, 'no one is willingly bad', and anyone who becomes bad does so 'because of some defective condition of the body and an upbringing that fails to educate (ἀπαίδευτον τροφήν)' (86d7–e2). These factors act on people 'against their will' (ἄκοντι), indeed, 'most of all against their will' (ἀκουσιώτατα) (86e2–3, 87b4). In Aristotelian terms, such failings – which embrace what are normally seen as moral as well as intellectual failings – are here ascribed to 'external' causes.[11] Correspondingly, people should not be blamed (αἰτιατέον) or held responsible for them. More precisely, any blame should be attached to those who 'implant' such failings, through social influence, rather than those in whom they are 'implanted' (87b4–6). This claim seems equally sweeping and far-reaching, although it is coupled with the recommendation to make use of one's education, habits, and studies to avoid being bad (87b6–8).

On the face of it, this is an astonishing passage and one that runs counter to much that is ordinarily supposed to be 'Platonic' thought.

Elsewhere, moral failings are explained either in purely psychological terms (in the *Protagoras*, *Gorgias*, *Republic*) or (in the *Phaedo*) by the idea of a psyche 'imprisoned' in an (alien) body, rather than integrally linked with it.[12] Although the idea that 'no one does wrong willingly' is, of course, a recurrent Platonic theme,[13] it is not normally coupled with the idea of body-based character or with a ringing denial of the agent's responsibility, in the way we find here. Plato's Timaeus sounds here, startlingly, like some version of a modern scientific (or, in 87b, social) determinist. How should we explain this surprising passage? Does it reflect a line of thought which is peculiar to the *Timaeus* or are there underlying points of contact with other Platonic arguments? The two major commentaries on the *Timaeus* in English in the twentieth century, those of Taylor (1928) and Cornford (1937), take diametrically opposed positions on this question. In doing so, they raise, by implication at least, substantial questions about how to interpret Platonic dialogues as well as about the significance of this passage.

Taylor adopts a strong reading of the passage and underlines the contrast with what he sees as typically Socratic or Platonic ideas. Taylor's interpretation of the passage reflects his general view that in the *Timaeus* Plato constructs a certain type of fifth-century 'physics', a synthesis of Empedoclean and Pythagorean themes, and also indicates his philosophical reservations about the validity of this kind of theory. This reflects, in turn, the assumption, shared by John Burnet, that Plato uses the dialogue form to reconstruct historically credible positions.[14] The physicalist account of psychology along with the 'scientific determinism' and denial of personal responsibility in *Timaeus* 86b–87b express Plato's view of what is implied by that type of naturalistic world-view. Despite the obvious echo of the standard Socratic-Platonic idea that 'no one does wrong willingly', Taylor emphasizes the contrast with other Socratic-Platonic comments which stress our responsibility, as agents, for our character and the validity of moral reproach (ὄνειδος).[15] He also highlights other Platonic passages where psychic and bodily faults and therapies are distinguished, rather than assimilated in the way they are here.[16] For Taylor, these are indications that Plato disowns the physicalist psychology and ethics of *Timaeus* 86b–87b.

Cornford, by contrast, adopts a relatively weak reading of the passage and takes it to be readily compatible with Platonic thought elsewhere. This reflects, in turn, his 'unitarian' approach to the doctrinal content of the Platonic dialogues. The claim is not taken to be that '*all* mental disorders are *solely* due to bodily states' or that what Timaeus calls psychic disease 'covers the whole field of what could be called "disorder of the soul"' (1937, 346, his italics). The subject of the passage is only that

subgroup of states which are the by-product of a combination of physical abnormality and of a socio-political context which fails to counteract the outcome of those defects. Cornford also takes the passage as reflecting not a physicalist view of psychology but rather a standardly Platonic dualism in which an immortal human soul is subject to the assaults of the physical environment, including the body (1937, 347). The citation in this context of the Socratic dictum 'no one does wrong willingly' reflects the idea that, even in this type of moral weakness, the 'true will' of the 'true self' of such people is for the good, although this is obstructed by their bodily defects (1937, 348). On this reading of the passage, Cornford finds it easily compatible with other Platonic ideas, including those passages in the *Laws* which explore the relationship between the Socratic dictum and more standardly moral and legal responses to wrongdoing.[17]

A more recent discussion, that of M.M. Mackenzie (now McCabe), outlines what is in some ways an intermediate position and an interesting one. Mackenzie, like Taylor, adopts a strong reading of the passage, and underlines the unusual character of the claim in the *Timaeus* that moral and intellectual failings derive from the bodily make-up. However, like Cornford (though more convincingly), she also brings out a connection with a rather pervasive Platonic line of thought. This is the idea that when people do wrong it reflects a type of psychological defectiveness which those concerned do not fully understand, rather than a deliberate choice to do wrong in full awareness of what this involves. Psychological defectiveness is interpreted as 'ignorance' in the *Protagoras* and *Gorgias*, 'disorder' in the *Republic*, and 'disease' in the *Timaeus*. It is true that nowhere else does Plato interpret the idea of vice as disease in the literal, body-based way he does in *Timaeus* 86b–87b. But Plato typically sees wrongdoing as a defect that the wrongdoer does not fully understand as such, and one which needs to be 'cured' by dialectic or by socio-political programmes rather than 'punished' in a more conventional sense. To this degree, the *Timaeus* passage, though 'an odd experiment...with the thesis that vice may be explained in terms of physical disease' (1981, 178), draws on a lasting vein of Platonic thought.[18]

Mackenzie's approach is suggestive both in methodology and in content. By implication here, and more explicitly elsewhere, she underlines the importance of following through the full force of a line of argument in a specific dialogue, even if it is in apparent contrast with other Platonic ideas.[19] However, she also shows how certain other Platonic dialogues (if also followed through in this way) convey a line of thought with certain underlying parallels to this one. The distinctive form of that line of thought can be brought out by contrast with Aristotle's famous

defence of moral responsibility in *Nicomachean Ethics* 3.5. Aristotle there sets out to meet the objection that some people are disabled from being virtuous because of their inborn or ingrained character, and therefore cannot be held responsible for the actions determined by that character. His argument is that people are at least partly responsible for the development of their character and are to that degree also responsible for the actions which flow from that character.[20] As regards its general approach, Aristotle's argument sets out to provide a theoretical justification of the conventional social practice of praising and blaming people for their actions and character.[21]

As Mackenzie brings out, Plato's characteristic line of thought, though worked out in various ways, is very different.[22] Whereas Aristotle argues that people must be treated as understanding the moral significance and the effects of their actions,[23] Plato pursues, in different ways, the idea that wrongdoing stems from the inability fully to grasp what virtue and vice involve. In the *Republic*, for instance, the defective figures of Books 8–9 are disabled by nature, upbringing, and social influences from developing the kind of character-structure that is compatible with full knowledge of the good. Similarly, we do not find in Plato an equivalent of the Aristotelian move of providing a theoretical basis for conventional practices of praise and blame for actions and character. Rather, the focus lies in evolving methods of therapy, whether individual (through dialectic) or socio-political, to shape or reshape the character and so prevent the motivation to wrongdoing. *Timaeus* 86b–87b is unusual in the extent to which it makes explicit the idea that blame is not a theoretically well-grounded response to wrongdoing, and also in linking this idea with the bodily basis of character. But, in so doing, it works out in a distinctive way a line of thought that has, as Mackenzie shows, significant parallels throughout the Platonic writings.[24]

I think that Mackenzie's reading provides the best starting-point for explaining this passage. It offers a plausibly strong reading of the claim, and underlines its distinctive character, while also relating it to certain recurrent lines of Platonic thought. How can her reading be taken further? I aim to do so, partly, by relating the passage more closely to the thinking of the *Timaeus* as a whole and to what is distinctive in that line of thought. There are two features of the *Timaeus* that are especially relevant. One is the idea that the psyche, while not itself physical, is integrally linked with the body in the universe as a whole and in human beings. It follows from this that the specific character of the body necessarily has an effect on the psyche with which it is linked. The other idea is that health, both physical and psychic – and psychophysical – constitutes a kind of symmetry or

structure and that disease derives from the disruption of this structure. This point is one aspect of the larger idea, running through the *Timaeus*, that the universe as a whole, as well as the human body, constitutes a structure, and one that is, in principle at least, amenable to mathematical analysis. The appropriate response to disruption of this structure is not to blame the person concerned but to offer guidance about how this structure can be repaired or restored. The combination of these points serves to explain further what leads Plato to develop in this striking way his recurrent idea of vice as disease.

One way of drawing out the significance for *Timaeus* 86b–87b of these larger themes is by reference to the later ancient reception of the dialogue. In a work on the influence of the bodily condition on the psyche, Galen gives a key place to this Platonic passage and to the associated idea that the psyche, at the cosmic and human level, is essentially embodied. Although the specific way that Galen works out this idea reflects his own particular intellectual concerns, his comments can help us to locate this passage within the relationship expressed in the *Timaeus* between psyche and body. The idea that psychophysical health constitutes a kind of structure or symmetry, which takes a comparable form in the universe and in human beings, has close parallels in Stoic thought. Although the precise nature of the importance of the *Timaeus* for Stoic thought is a matter of conjecture, it seems clear, nonetheless, that this dialogue was deeply influential on their providential world-view. There is no evidence, as far as I know, that the Stoics paid special attention to this specific passage, but the idea of psychic disease as a disruption of symmetry or structure, and the correlated idea that blame is an inappropriate response to psychic illness, figure prominently in Stoicism also, in a way that can usefully be juxtaposed to the themes of *Timaeus* 86b–87b.

II. Galen and the body-based psyche

The idea to be explored in connection with Galen is that in the *Timaeus* the psyche is seen as integrally linked with the body, and that this linkage explains the striking claims of *Timaeus* 86b–87b. I consider, first, the way that Galen uses this passage in support of his view of the body-psyche relationship, and then ask how far this interpretation explains the claims of 86b–87b, taken in the context of the comments in the *Timaeus* on body and psyche.

Galen gives this passage a prominent place in his treatise, *That the capacities* (*dunameis*) *of the psyche depend on the mixtures* (*kraseis*) *of the body* (hereafter, *Capacities*).[25] Galen's treatise makes, in general terms, the claim that human psychological states depend crucially on the bodily

condition, but this thesis is formulated in a specific form. Galen holds that the body is composed of the four humours (blood, black and yellow bile, phlegm), each of which is marked by the dominance of one of the four elements (earth, air, fire, water) and by two of the four primary qualities (hot, cold, wet, dry). The 'blending' or 'mixture' (*krasis*) of the humours and qualities is different in different parts of the body, including the three parts (brain, liver, and heart), which contain the three sources of action (*archai*), with their different capacities or faculties (*dunameis*). The different forms of 'blend' or 'mixture' determine the different capacities of each of these three organic centres. Variation in this mixture in different individual human beings (or in different individuals at different times) produces variation in psychological character and state.[26] It is this relatively precise claim that Galen is making in this treatise, in support of which he cites the *Timaeus*, including 86b–87b.[27]

How does the position of this treatise relate to Galen's thinking in general about the psyche–body relationship? P.N. Singer, in a helpful survey, highlights a tension in Galen's thought between teleological and materialist approaches to the question of bodily composition. *The usefulness of the parts*, for instance, demonstrates the way that the structure of the human body serves as an instrument for the functions of the psyche and suggests that, in this respect as in others, the universe is pervaded by an organizing intelligence. *Capacities*, by contrast, represents an extreme in the other direction. It argues that the way that the sources of action (*archai*) and capacities of the psyche function depends on the physical 'mixture' present in each body at any given time.[28] A similar ambivalence can be found in Galen's thinking about the relationship between the psyche and the body. On the one hand, in *Capacities*, Galen's emphasis is on the thought that the physical condition (the mixture of humours and qualities) has a determining effect on the psychological character and state. He questions whether this fact (as he sees it) is compatible with the general Platonic belief in an immortal psyche whose nature is distinct and independent from the body. In particular, he argues against those Platonists who claim that the state of the psyche is largely unaffected by that of the body.[29] On the other hand, he draws back from the position of those who claim that 'the substance of the psyche is [nothing more than] a mixture or capacity of the body'.[30] Galen maintains an open mind on the question of the nature of the relationship between the psyche and body. In a late work, *On my own opinions*, he concedes that he has not formed a definitive view about this relationship and about whether, or in what way, the psyche can exist separately from the body. However, a characteristic approach, evident in *On the doctrines of Hippocrates and Plato* (*PHP*), for instance, is to treat the functions of the psyche as essentially embodied. Therefore he can refer indifferently to the operations of the three parts of the psyche (rational, spirited, and appetitive) or of the physiological organs (brain, heart, and liver) in which he sees these as located.[31]

How far does Galen's treatise identify an important feature of the *Timaeus* which can help us to interpret and explain the claims made in 86b–87b? Certain features of his account reflect his wish, evident throughout the treatise, to find support in earlier thinkers for his specific thesis about the bodily constitution. So he pays special attention to indications in the *Timaeus* (or in Hippocratic works or in Aristotle)[32] that the psychological state is dependent on the mixture of qualities or humours. For instance, referring to Timaeus' account of the composition and development of the human being, he cites the (gradually diminishing) 'stream of growth and nourishment' from which human development occurs in support of his own view that 'wetness brings about mindlessness and dryness understanding'.[33] Similarly, Timaeus' comments on psychic illness in 86b–87b are taken to support a specifically humoral analysis. He cites the references to 'phlegm' and 'bilious humours' to support his claim that 'Plato is...aware of the negative effect of bad bodily humours (κακοχυμία) on the psyche'.[34] The first point certainly imports Galen's own framework, while the second presupposes, without argument, that Plato has a determinately humoral model in mind.[35] In this respect, it may seem that Galen's discussion does not take us very far towards highlighting and explaining the distinctive character of Plato's thinking in this passage.

However, there is more validity, I think, in Galen's general assertion that the *Timaeus*, including 86b–87b, assumes a closer linkage between psyche and body than is evident elsewhere in Plato's writings or acknowledged in many accounts of 'Platonism'. He asks how we can square the idea of the psyche as an independent, separate, immortal entity with the picture of the embodied human psyche, with its functions instantiated in three bodily locations and affected by physical factors and changes.[36] He also challenges the interpretation of certain Platonists who concede that the functions of the psyche are adversely affected by physical disease but who deny that a good physical state contributes to psychic health.[37] Galen, like ancient commentators generally, assumes a 'unitarian' reading of Plato, according to which we have the right to expect doctrinal consistency between the dialogues.[38] But it would be possible to restate Galen's point more powerfully in terms of a contrast between the viewpoint of the *Phaedo*, for instance, and the *Timaeus*. Scholars sometimes suggest, not

implausibly, that the (broadly) teleological and providential world-view of the *Timaeus* can be seen as the realization of the kind of account of the cosmos which Socrates wanted at one point in the *Phaedo*, and coupled there with criticisms of Anaxagoras' mechanist picture.[39] However, we need to combine this suggestion with the recognition of the contrast between the stark psyche–body dualism of the *Phaedo* and the much more integrated picture of the psyche–body relationship given in the *Timaeus*. One passage in the *Phaedo* which highlights the difference is 66a–69d. Here the body is presented as an obstacle, because of the diseases, emotions, and desires it generates, to the search for knowledge and the development of real virtue.[40] This can be contrasted with the close linkage claimed between the sickness – and health – of the body and that of the psyche in *Timaeus* 86b–89c, a linkage which is taken to bear directly on the question of the development of virtue.[41] Whether we should call this difference one of philosophical *doctrine* is a separate, and complex, question.[42] But I think there is a strong case for seeing very different lines of argument; and Galen's treatise (which assumes what I am calling a 'strong' reading of 86b–87b) serves to underline this point.

The feature emphasized by Galen's treatise, the focus on the integration of psyche and body in human beings, is taken further by two other distinctive claims in the discussion that follows *Timaeus* 86b–87b (i.e. 87c–90d). One claim is that illness and health derive crucially from the interrelationship between psyche and body. In determining our patterns of physical and mental activity, we need to take into account that we are a 'combination' (συναμφότερον) of psyche and body. Sickness derives from disproportion between psyche and body and health from a properly proportionate relationship.[43] To gauge the distinctive character of this claim, we can contrast it with the superficially similar suggestion in the *Republic* that psychic harmony (later described as psychic 'health') derives from a combination of physical and artistic education (γυμναστική and μουσική). In the *Republic*, the key thought is that both types of education are really established 'for the sake of the psyche' (to bring about the harmonization of two parts or motives in the psyche) and only incidentally for the sake of the body as well as the psyche.[44] In the *Timaeus*, the point is, rather, that physical and mental education need to be brought into proportion to each other in order to achieve the overall health (understood as proportion or symmetry) of that 'combination' of psyche and body which constitutes the human animal.

A similar emphasis is found also in the following passage (89d–90d). Here, as sometimes elsewhere in Plato's dialogues, we find the idea that the highest possible life for human beings is to 'follow god' (or 'the divine' or 'daemonic') as far as we can. Here also, as elsewhere, this is seen as realized in the use of our minds to seek truth through philosophy.[45] What is unusual in this passage, however, is the presentation of intellectual activity as taking (in some sense) physical form. Philosophical activity directed at knowledge is presented as consisting of circular motions. More precisely, it is presented as achieving a set of perfectly circular motions which are also those of the heavenly bodies (which are also conceived as intelligent).[46] Although it is easy to take such language as merely metaphorical, David Sedley, in particular, stresses that it seems to be meant quite literally here. For instance, the later linkage between the circular motions of philosophy and the circular shape of the human head suggests that the point is meant literally.[47] Also, this kind of movement is presented as the highest of a series of (physical) movements of which our life as a psychophysical complex consists, and we should so conduct our lives that these movements are 'proportionate' to each other.[48] The idea therefore of philosophy as a mode of 'following god' is conceived here in a way that reflects the high degree of integration between psyche and body that is characteristic of the *Timaeus*.

These two ideas[49] can, to a degree, be seen as confirming the emphasis in *Timaeus* 86b–87b on our nature as integrated psychophysical 'combinations' which is underlined by Galen's treatise. In this respect, they serve to explain the distinctive claim of 86b–87b that psychic illness is the product of our physical state. If we are, at a fundamental level, 'combinations' of psyche and body (87e5–6), it follows that our bodily condition, whether sound or defective, well or badly proportioned to our psyche, will have a decisive impact on the condition of our psyche. However, it should also be noted that the two later passages (87c–89c, 89d–90d) also introduce a rather different way of looking at this matter. The point is not so much (as it is in 86b–87b) that psychic illness derives from bodily defects, implying that we are, fundamentally, bodies, but rather that we are integrated combinations of psyche and body, and that sickness and health, both of body and psyche, depend on maintaining a proportionate relationship between them.[50] The second thought is not in direct contradiction to the first. The mutual dependence of psychic and bodily illness and health is compatible with the idea (stressed in 86b–87b) that psychic illness derives, in each instance, from physical defectiveness. The compatibility between the ideas is increased by the fact that 'psychic' functions (such as philosophical activity) are themselves conceived as in some sense physical processes.

The second strand of thought in this part of the *Timaeus* is not fully reflected by the approach of Galen in *Capacities*. There the emphasis

falls wholly on the dependence of psychic characteristics on physical ones, reflecting the role of this treatise in expressing the more 'mechanist' dimension of Galen's thought about the psyche–body relation. *Timaeus* 87c–90d introduces the rather different motif that health and sickness are to be understood in terms of the proportion and disproportion of psyche and body (as integrated components of the human animal). Although that new motif could also be analysed in Galenic terms by referring to the more teleological strand in his thought,[51] I think it is better analysed by reference to a second line of thought influenced by the *Timaeus*, that of Stoicism. Reference to Stoic ideas can, I think, help us to see further how the second line of thought in the *Timaeus* illuminates the first. It can also help to place in context the second striking claim at 86b–87b, that the body-based character of psychic illness means that blame is an inappropriate response to vice.

III. Health as structure: Plato and Stoicism

First I show how the ideas of health as structure and disease as disruption of structure fit in with a pervasive line of thought in the *Timaeus*. Then I bring out how Stoic theory develops this line of thought (partly in response to the *Timaeus*), and how the Stoic response can help us to define the view given in the *Timaeus* of the psyche–body relationship. I suggest finally that the links between Stoic and Platonic thought in this area can help us to make sense both of the psyche–body relationship as presented in *Timaeus* 87a–90d and of the related claim in the same passage that psychic illness merits therapy instead of blame.

The line of thought in the *Timaeus* that I have in view can be identified by reference to the *Phaedo*. As noted in the previous section, the *Phaedo* adumbrates the *Timaeus*' picture of a teleological cosmos but combines this with a sharp dualism between psyche and body and also between Forms and particulars. The *Timaeus*, by contrast, can be seen as conveying a more consistently 'one-world' view in which body (and, more broadly, matter and space) as well as psyche are conceived as co-ordinated aspects of a coherent, purposive cosmos.[52] One way in which this world-view is developed is through the idea of 'proportion' or 'ratio' (ἀναλογία), an idea closely linked with that of 'symmetry' or 'harmony' (συμμετρία). The key thought is that the underlying structure of body as well as of psyche, and of the combination of psyche and body, can be defined in terms of 'proportion', 'ratio', or 'symmetry'. Thus, to put it very generally, value is not just attached to one privileged aspect of reality (for instance, psyche rather than body) but to reality as a whole in so far as this whole exhibits an intelligible and orderly structure.[53]

The idea of 'proportion' (ἀναλογία) is introduced in the *Timaeus* as a means of creating the best kind of 'bond', namely that which 'makes a unity of itself together with the things bonded by it'.[54] This idea is applied, firstly, to the relationship between the four elements making up the universe as a cohesive solid object (*Tim.* 31b–32c). It is then applied, in a more complex way, to the relationship between the components and the movements of the world soul or psyche, and analysed in terms of ratios (35a–36d). This set of ideas is then redeployed in connection with the composition of the human being. The human body is conceived, like the cosmos, as a unified structure of elements, informed by the ratio-governed movements of the psyche.[55] The initial impact of the combination of body and psyche is said to disrupt this set of ratios, but they are restored by a proper process of development and education.[56] The correspondence between the human being and the cosmos is confirmed by the repeated suggestion that humans should use their senses and mind to restore within themselves the ratio-governed circular movements that are also found in the cosmos (47b–d, 90c–d).

The theme of proportion or ratio as a basis for structure is closely linked with that of health and sickness. The fact that the cosmos is unified and stabilized by proportion is presented as enabling it to be immune from old age and sickness (*Tim.* 32b–33a). The person who restores a stable set of ratio-governed movements in his embodied psyche is said to be 'perfectly whole and healthy (ὑγιής)' and to have escaped 'the greatest of sicknesses' (44c1–2). Later, disease and health are defined in terms of the disruption or maintenance of a 'proportionate' (ἀνὰ λόγον) set of relations between the four elements and other units of composition (82a–b, and especially b3–7). The linkage between these themes is taken further by the suggestion, noted earlier, that health depends on establishing a proportionate relationship between psyche and body, and that disproportion between them generates disease (87c–88b). A proper regime of physical exercise sets up a stable set of movements in the body, and a proper regime of intellectual exercise does so in the psyche, and in both respects the human being attains the proportionate stability that inheres in the cosmos (88c–e, 90c–d). In a further twist, disease itself is said to have a determinate structure or constitution (σύστασις) and to need to run its course in the same way as living beings do without being disrupted by drugs (89b–c).

How far does this line of thought also explain the claim of 86b–87b about the physical basis of psychic illness? Clearly, the thought in that passage is not quite the same as in 87c–88b, namely that disease arises from a breakdown in the proportion between body and psyche. The suggestion in 86b–87b is that physical defect causes psychic illness, rather

than that defects in each area cause illness, reciprocally, in the other area.[57] However, 86b–87b reflects the related idea that the human being constitutes a psychophysical system which depends on proportionate relationships, and that a breakdown in these relationships causes illnesses (which are at once physical and psychic). When the origin of diseases is explained in 82a–b, Timaeus lists various ways in which the normally structured and proportionate relationship (ἀνὰ λόγον, 82b3–4) between the components of the body can be disrupted. These include the 'unnatural increase or deficiency' of one of the four elements at the expense of another (82a2–3), 'unnatural occurrences and changes', as when cold parts become hot (82a7–8), and, more broadly, anything that 'strikes a false note' (πλημμελήσῃ) in relation to the stable structure of the body.

This general model underlies the lengthy analysis of physical diseases in *Timaeus* 82c–86a, as well as the briefer account of psychic diseases, understood as body-based, in 86b–87b. A key idea, highlighted earlier, is that *excessive* (ὑπερβαλλούσας) pleasures and pain generate various forms of 'folly' and 'madness' (86b4–c3). The example of excessive pleasure is hypersexuality, which is explained by '*much* (πολὺ) fluid seed around the marrow', like a tree that is 'more fruitful than is normal', literally 'than is symmetrical' (τοῦ συμμέτρου, 86c3–5). The condition is also interpreted as one that is (abnormally) 'fluid and moist' (ῥυώδη καὶ ὑγραίνουσαν, 86d4–5).[58] A further type of disruption is caused by the accumulation of phlegms and humours which, unable to escape from the body, 'mix their own vapour with the motion of the psyche and so are confused (ἀνακερασθῶσι) with it.'[59] At the start of this discussion (in Section I), I cited this analysis as bearing out the claim that psychic illnesses take their starting-point from physical defects. However, it might be better understood in the light of the dialogue's conception of health as proportion and structure. The primary point may be that such phenomena represent types of disruption of structure. This disruption is both physical and psychological, the latter type of disruption following from the former (if uncorrected by social or personal remedies, 87b). In the succeeding passage (*Tim.* 87c–88b), the disruption is also physical and psychological, though generated here by the special case of disproportionate activity in the body or psyche. Earlier I suggested that these two passages might seem to pull in different directions, the first stressing the primacy of the body in generating psychic illness, the second describing a more reciprocal relationship in which psyche and body can disturb each other. However, I also suggested that a shared theme of both passages is that human psyche and body are integrally linked. The latter idea can now be specified further: psyche and body are linked because they constitute a coherent structure,

characterized by proportion, symmetry and ratio-governed movements. Correspondingly, disease is to be understood as the disruption of this structure. This description holds good regardless of whether the disease is physical (82c–86a), psychic – though also physical, 86b–87b – or psychophysical (of the type identified in 88a–b).

I subsequently proposed that Stoic thought might be more helpful than Galenic in defining this line of thought. What justifies this suggestion? Galen, at least in *The Capacities of the Psyche*, stresses the idea that psychic illnesses are fundamentally physical ones, rather than having both psychic and physical illnesses represent a disruption of natural proportion and structure.[60] But in Stoic thought we can find several features which are suggestively close to the line of thought being traced in the *Timaeus*. These include a teleological conception of the human being as a coherent psychophysical structure, and vice as psychic disease (and a disruption of that structure). They also include the idea that the appropriate response to vice, understood as psychic disease, is not blame but therapy. That there should be such points of resemblance is not surprising because the Stoics seem to have drawn these and related ideas from Plato, including the *Timaeus*, either directly or through the mediation of later Academic teaching. The attempt to track such influence is a preoccupation of some recent scholarship.[61] Here my concern is rather to show how the Stoic version of such ideas can help us to define the Platonic line of thought, and especially the way in which the repudiation of blame is related to the idea of psychic illness as disruption of structure.

Earlier in this section, I outlined ways in which the thinking of the *Timaeus* could be differentiated from Platonic thought elsewhere, as for example in the *Phaedo*. In summary, the *Timaeus* presents a teleological, 'one-world' view, in which value is attached not to one aspect of reality (psyche or Forms) but to reality as a whole, in so far as this exhibits order, intelligibility, and structure. The Stoics can be seen as adopting this world-view and taking it further. The features that have been seen since antiquity as points of resemblance between the *Timaeus* and Stoic thinking can be understood as falling under this general heading. This holds good for the idea that the cosmos as a whole and the human being are both purposively designed, coherent structures.[62] A related idea, common to the *Timaeus* and Stoicism, is that humans are constitutively capable of recognizing the order and regularity in the universe and of reinforcing their own structure accordingly.[63] I have suggested elsewhere that the picture in the *Timaeus* of an embodied tripartite psyche (operating, together with the bodily organs, as a unified system) anticipates the Stoic model and may have influenced it.[64] As Thomas Johansen has recently underlined,

the *Timaeus* also shows how the human body is functionally adapted to enable a coherent synthesis of psychological processes, for instance, through the integration of circular and linear motions.[65]

The Stoics clearly go further in this direction than the *Timaeus* does. For them both psyche and body are physical entities, but of rather different kinds.[66] This is related to their reduction of the three-fold set of causal principles in the *Timaeus* (craftsman-god, Forms, and receptacle) to two, the active and passive principles.[67] A similar conceptual shift underlies the Stoic insistence that rationality informs all (adult) human psychological processes and that, in this sense, human psychology is unified.[68] However, in taking further the emphases of the *Timaeus*, the Stoics highlight what are at least partial moves in the same direction in Plato's dialogue. In Plato's universe too, the world psyche is in some sense fused with the world body, making a single entity that is in principle intelligible as a 'harmonic', mathematically structured system.[69] The presentation of psychic diseases as fundamentally physical, or of disease as the outcome of disproportion between psyche and body (*Tim.* 86b–87b, 87c–88b) can also be understood in similar terms. Clearly, psyche and body are still seen as more differentiated in kind than in Stoic thought.[70] But there is, nonetheless, a shift towards a conception of the human being as a cohesive and (in one sense) 'psychophysical' structure. The very striking and unqualified character of Plato's claims, especially at *Tim.* 86b–87b, may be interpreted as a deliberate move in this direction, rather than as the explanation of psychic illness in physical terms, as Galen supposes. A further merit of the 'Stoic' reading of this passage is that it shows how *Tim.* 86b–87b is compatible with 87c–88b, as well as with the larger picture of psyche–body relations in the *Timaeus*, which cannot readily be interpreted in the light of the reduction of psychological to physical categories.

What about the Stoic idea of passions (and vice generally) as psychic illnesses? Does this also represent an accentuation of the line of thought of the *Timaeus*? This Stoic theme seems to be indebted to the more pervasive Platonic idea of vice as a distortion of the normal psychological state (as ignorance, disorder, or disease), rather than to the distinctive idea in the *Timaeus* of body-based psychic illness.[71] Also, the Stoics standardly compare psychic with physical illness, which implies that the two types of illness are different.[72] However, the Stoic conception does reflect the normal Stoic view that psychic processes are at the same time physical ones. A passion, for instance, includes intense psychophysical reactions, such as 'swelling' and 'shrinking', as well as a set of beliefs. In addition, a passion is seen as a disruption of a normal state of psychophysical stability and proportion, an idea exemplified in the image of running,

out-of-control legs instead of walking ones.[73] In these respects, the Stoic understanding of passion and other forms of vice as psychic (and thus also physical) illness reflects a broadly similar line of thought to that of the *Timaeus* and thus helps us to understand its coherence. Gretchen Reydam-Schils suggests further that this type of Stoic conception of passion may be influenced by the characterization in the *Timaeus* of the disruption of naturally ordered movements that follows the embodiment of the human psyche.[74] Whether or not this is so, there is sufficient in common between the Platonic and Stoic ideas of psychic illness to find each of them instructive in making sense of the other.

However, the most substantial benefit of juxtaposing Stoic thought with that of the *Timaeus* on this subject may lie in a linkage made in both theories. This is the connection between the idea that vice is to be understood as psychic (and physical) sickness and that the appropriate response is not blame but explanation and an attempt at cure. This linkage is not exclusive to the *Timaeus*. As M.M. Mackenzie has brought out, this thought is pervasive in Plato's writing and stems from the ideas that 'no one does wrong willingly' and that vice reflects ignorance, disorder, or disease, all of which need to be cured rather than stigmatized.[75] The Stoics adopt a similar line of thought, and one that shows heavy Platonic influence. Vice is understood as an expression of a kind of defectiveness ('folly' or 'madness') which we would all want to be free from, if we could be led to recognize its nature. The inappropriateness of blame as a response to wrongdoing is given special emphasis in Stoic practical ethics, and coupled with the call to cure error rather than to criticize it.[76]

Again, the similarity between the two lines of thought helps to bring out the coherence of the shared position. But how far does Stoic thought share the particular view of the *Timaeus* (especially that in 86b–87b), as distinct from Platonic thought in general? The Stoics, like Plato in the *Timaeus* and Galen, acknowledge the influence of such external factors as heredity, environment, and social context in shaping ethical character.[77] On the other hand, they combine this with the belief that human beings are properly held responsible for their actions and character. As Susanne Bobzien brings out in a searching examination of this topic, their reasons for doing so are different from those of Aristotle (in *NE* 3.5) and from those of the later Peripatetic tradition. The argument does not turn on the claim that in their actions or in the course of their development bad people have, or have had, the opportunity to act differently from the way they do. The central thought is that (adult) human actions necessarily involve rationality and that rationality confers responsibility. Two related beliefs are that 'all human beings have the starting-points of virtue',[78]

and that we can, at any point in our lives, reshape the set of beliefs that determine our actions. Stoics thus combine the belief that humans are psychophysical units whose character is significantly shaped by external factors with the belief that their actions and character are still, in a decisive sense, 'up to them'.[79]

How do the claims of *Timaeus* 86b–87b (and, more broadly, 87c–90d) look from the standpoint of this set of Stoic ideas? From a Stoic perspective, Timaeus moves too quickly from acknowledging the importance of our psychophysical nature (and our social environment) to the conclusion that people should not be 'blamed' (αἰτιατέον), or held responsible for the ethical failings that reflect these factors.[80] It is true that Timaeus also goes on to point out the scope we have for 'therapy' of our nature as 'combinations' of body and psyche. This therapy includes doing all we can to ensure that we maintain due 'proportion' between body and psyche, and between the motions of the three parts of the psyche. This therapy can help to counteract the psychic as well as the physical diseases that derive from disproportion between body and psyche, as well as to promote the health and happiness that derive from the properly proportioned exercise of these components.[81] (Whether this therapy would be effective in counteracting the specific body-based psychic illnesses cited in 86b–87b is not wholly clear.)[82] But Timaeus does not, as the Stoics might, infer from the brain-based role of reason in the embodied tripartite psyche that all human actions involve rationality and are to that degree open to praise and blame.[83] To this extent, Timaeus' approach in 86b–90d differs from the Stoic one despite the general similarities between Platonic and Stoic approaches cited earlier and the specific similarities just noted. However, the fact of these similarities enables us to pinpoint the distinctive character of the claims in *Timaeus* 86b–87b in a way that would not be possible in a less close and fine-grained comparison.

I conclude this discussion by asking in what sense according to the *Timaeus* (as my title puts it) it is 'the body's fault' if we suffer the psychic illnesses of 'folly' and 'madness'. In outlining the alternatives, I consider some modern interpretations alongside the ancient ones discussed. The least relevant approach, in my judgement, is that of Cornford, according to which such body-based psychic illnesses are just one instance of the general Platonic belief that we are essentially *psychai*, subject to the assaults of the physical world, including those of the body. More credible is the reading, shared by Taylor (and Galen in *Capacities*) according to which we are fundamentally bodies, and so psychic illness derives directly from bodily defect.[84] However, the most credible view (and the one that fits *Timaeus* 87c–90d best as well as 86b–87b) is the one I am associating – though not identifying – with the Stoic approach. In this view, we are essentially 'combinations' of psyche and body, and constitutively adapted to becoming well-proportioned structures of psyche and body, as well as well-proportioned combinations of psychic motions. If we suffer psychic illnesses, this is (to a degree) 'the body's fault' in the way stated at *Timaeus* 86b–87b: the particular body we have is not so well-structured, as a body, as it should be. But this condition may also derive from our failure to deploy the kinds of psychophysical therapy presented in 87c–90d, as well as from the absence of the 'curative teachings' that a good society could provide (87b, and especially b2–3). This view is not only, I think, the most plausible interpretation of this passage but also one that shows the credibility of Timaeus' claim that, in the sense defined, psychic illness is 'the body's fault.'

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Notes

[1] Because of the difficulty of finding a single (or any) English equivalent, the Greek term 'psyche' (and psychic) is normally left untranslated in this discussion, although the meaning of the term in its context is sometimes specified further.

[2] This issue is pursued in Gill (forthcoming).

[3] For other examples of this approach, see Gill 1997 and 1998, 130–7.

[4] Two recent translations adopt these different readings. Brisson 1992, 209–10, suggests the first reading: 'tandis que les maladies qui affectent l'âme résultent comme suit de l'état du corps'; the second translation cited is that of D. Zeyl in Cooper 1997, with 'soul' revised to psyche (see n. 1 above).

[5] For a defence of the strong reading, see Mackenzie 1981, 176–7, discussed further below; also Pigeaud 1981, 52–3.

[6] 'Occur' is συμβαίνει γιγνόμενα, literally 'happen to occur', which is implied in the second clause also.

[7] Note especially 'virtually all (σχεδὸν δὴ πάντα) types of surrender to pleasures' (86d6); 'every kind of (παντοδαπά) illness of the psyche' (87a2); 'all (πάντες) of us who are bad' (87b3).

[8] See further *Tim.* 82d, 91a; also Cornford 1937, 345, n. 1; Brisson 1992, 277, n. 777.

[9] The three types of reaction in 87a5–7 seem to be correlated with the three embodied parts of the psyche described in 69d–72d; for ill temper and good

temper, conceived physiologically, in the liver, see 71b–d.

[10] *Tim.* 87a7–b4, esp. 'whenever people with a bad (physical) constitution (κακῶς παγέντων) have bad political frameworks (πολιτεῖαι)...and no forms of learning that could cure (ἰατικά) these things are learnt'.

[11] On the contrast with Aristotle *NE* 3.1–5, see further below.

[12] See e.g. *Phaedo* 66b–67a, 69b–c, 83d–e.

[13] See e.g. *Prot.* 345d–e, *Gorg.* 509e, *Laws* 731c, 734b, 860d.

[14] See Taylor 1928, 13–27, esp. 17–19; also Burnet 1937, xxxiv. Probably no scholar nowadays would adopt this view of the function of the Platonic dialogue-form. However, the idea that each dialogue constitutes its own (semi-fictional) 'world' and context of argument is one that some current scholars would embrace; see further Gill (forthcoming).

[15] Taylor 1928, 611–20, referring to, e.g., Plato *Apol.* 30e, 41e, *Rep.* 617e, *Laws* 926d.

[16] Taylor 1928, 614–15, referring to *Rep.* 609a–10b and *Soph.* 228a–e.

[17] Cornford 1937, 348–9, referring to *Laws* 731b, 860d.

[18] Mackenzie 1981, 142–3, 175–8; more broadly, 134–78; on the negotation between this set of ideas and more conventional thinking about punishment as a social institution in *Laws* (esp. 860c–62d), see Mackenzie, 195–204.

[19] See further McCabe 1996. McCabe is now general editor of a monograph series devoted to exploring from an analytic perspective Platonic dialogues one by one, as cohesive arguments. On this approach, see also Gill (forthcoming).

[20] Aristotle *NE* 3.5, esp. 1141a3–21, 1141a31–b25. The argument has been much analysed; see e.g. Irwin 1980, 139–42; Sorabji 1980, 229–33.

[21] See Aristotle *NE* 1113b15–41a3, esp. 1113b21–6.

[22] Mackenzie 1981, 142–3, esp. n. 31, which cites a celebrated comment by D. Furley 1967, 194, on Aristotle's argument: 'It is odd that Aristotle never...asks himself why the discipline of parents and teachers is not to be taken as an external cause of men's dispositions. Our own experience of "juvenile delinquency" and the generally held belief that young people's crimes may be due not to wickedness but to family environment raise this point at once.' Plato, *Tim.* 87b, by contrast, does make this kind of point. For the contrast with Aristotle, see also Taylor 1928, 611.

[23] See esp. Aristotle *NE* 1114a4–12.

[24] See further Mackenzie 1981, 140–6, 173–8. For a partly similar view, see Gosling 1973, 82–8, though based on a relatively weak reading of the argument of *Tim.* 86b–87b (Gosling, 86–7).

[25] ὅτι ταῖς τοῦ σώματος κράσεσιν ἕπεσθαι τὰς δυνάμεις τῆς ψυχῆς. For text, see Marquandt, Müller and Helmreich 1967 (English translation in Singer 1997). There are no standard English titles for Galen's treatises; other titles for this work (here *Capacities*) include *The Soul's Dependence on the Body* (Singer).

[26] The latter claim is sometimes formulated as being that the 'substance' (*ousia*) of the psyche differs in this way in different individuals and temporary conditions; see e.g. ch. 2, 769 (the numeration is that of the standard Kühn edition). For the general thesis, see chs. 1–3, 767–74. See further Singer 1997, xxviii–xxxvi; also

von Staden (forthcoming), a particularly useful account.

[27] See ch. 6 (789–91), citing *Tim.* 86e–87a, 86c–d, and 86d–e; also ch. 10 (812–13), citing *Tim.* 87b.

[28] Singer 1997, xxx–xxxv. This variation seems to reflect both the divergent intellectual influences and the different argumentative contexts and opponents in different works.

[29] See *Capacities*, ch. 3, 776–7, 779, chs. 9–10, 805, 807–11.

[30] *Capacities*, ch. 4, 782, trans. Singer 1997, p. 157 (modified): τὴν οὐσίαν τῆς ψυχῆς κρᾶσιν ἢ δύναμιν εἶναι τοῦ σώματος. This position is ascribed to Andronicus the Peripatetic; Andreas of Carystus adopted a similar view.

[31] For the approach of *PHP*, see e.g. *PHP* 6.8.57–72 (Kühn 577–81), cited by Singer 1997, xxxviii. A similar complexity in Galen's thinking about the relation between psyche and nature (*phusis*) is brought out by von Staden (forthcoming). See further Hankinson 1991; Tielemann 1992, xxii–xxxvi.

[32] See e.g. ch. 8 (798–804), referring to Hippocrates, and ch. 7 (791–8), referring to Aristotle's *Parts of Animals* and *History of Animals*.

[33] Ch. 4 (780–2), referring to *Tim.* 43a–b, 44a–b; the phrase is cited from Singer 1997, p. 156.

[34] Ch. 6 (789–90), referring to *Tim.* 86–87a; trans. Singer 1997, p. 160.

[35] See also Galen's comparable treatment of Hippocratic evidence in ch. 8 (798–9), noted by Singer (1997), note on p. 165 (pp. 419–20).

[36] For these aspects, see e.g. *Tim.* 41c–d, 42b–c (immortal psyche); 69d–72d, 89e–90a (embodied tripartite psyche); 42e–44c as well as 86b–87b and 88a–b (psyche affected by physical factors).

[37] See ch. 3, esp. 772–3, 775–7, 779, and ch. 4, esp. 780–3; also ch. 9, esp. 805, 808.

[38] See Sedley 1996, 80, on this general tendency.

[39] See *Phaedo* 96a–99c; also Sedley 1989–90.

[40] See esp. *Phaedo* 66a–67a, 69b–d.

[41] On this contrast, see also Pigeaud 1981, 53–5; Joubaud 1992, 226.

[42] On the issue of the sense in which Platonic dialogues contain 'doctrines', see Gill 1996; on the question of the relationship between the arguments of different dialogues, Gill (forthcoming).

[43] *Tim.* 87c–89a, esp. 87d2–3 ('no proportion or disproportion more important than that of the psyche as such to the body as such'); 87e5–6 ('the combination (of body and psyche) which we call the living being', ζῷον); 'disproportion between psyche and body generates sickness in the *other* part' (88a–b).

[44] *Rep.* 410c, 411e–12a; also Joubaud 1992, 231–2. The ideal of 'psychic health' is introduced in *Rep.* 444d–e, though prefigured by the comparison between doctors and judges in 408d–10a. The characterization of the psychic effects of *mousikē* suggests a quasi-physical (or psychophysical) process, e.g. the 'cutting' of the 'sinews' of the psyche (411b), but this suggestion is not made explicit.

[45] See e.g. *Theaet.* 176a–c, *Alcib. 1*, 133b–c, *Laws* 716a–d; also Aristotle *NE* 10.7, 1177b6–78a8. For a survey of this Platonic theme and its ancient reception, see Annas 1999, 31–51.

[46] *Tim.* 90a–d, esp. c7–d5, 89a1–3; also 36c–37d, 43a–44c. In what sense are the motions of the psyche (cosmic or human) physical? Johansen (forthcoming) suggests that they may possess spatial extension but not depth and solidity (and hence visibility, *Tim.* 31b4–8).

[47] Sedley 1997, 329–30, referring to *Tim.* 44d3–6, 76a, and 91e–92a.

[48] *Tim.* 88b–89a, esp. 88b5–c6, 89a1–3; 89e–90a, esp. 90a1–2, 90c7–d1.

[49] i.e. the stress on keeping body and psyche 'proportionate' (*Tim.* 87c–89a) and on intellectual activity as a type of motion (89e–90d).

[50] See esp. references in n. 48 above; also 89e4–90a2, bearing in mind that these psychic motions are in some sense also physical.

[51] On these two strands in Galen's thought, see Singer 1997, xxx–xxxv.

[52] Of course, not everyone reads the *Timaeus* in this way. In antiquity, Plutarch adopted a dualist reading of the world-psyche (*Mor.* 441f–42a), developed at length in *Generation of the Psyche in the Timaeus*; see also Cornford's dualist interpretation, outlined in Section I.

[53] For readings which accentuate this line of thought, see e.g. Joubaud 1991, 281–8; Brisson 1992, 41–3, 47–8; Johansen (forthcoming); see also Frede's (1996) 'one-world' interpretation of the world-psyche, focused on cognition.

[54] *Tim.* 31c2–3, trans. Zeyl in Cooper 1997; see also 32c1–2.

[55] *Tim.* 43a. The idea of the universe as a 'proportioned' (ἀνάλογα καὶ σύμμετρα) compound of elements is reiterated at 69b (esp. b4–5), just before the account of the human being as a system centred on the embodied tripartite psyche (69c–72d).

[56] *Tim* 43b–44c; cf the structured cosmos that is the outcome of interfused psyche and body (36e–37a).

[57] See esp. 87e6–88a7: a disproportionately energetic psyche (or intense and combative psychic activity) causes physical illness; 88a7–b5: an over-predominant body induces in the psyche the illness of ignorance. For an analysis of 86b–87b, see Section I above.

[58] '...a condition of a single kind of thing [marrow] which, because of the porosity of the bones, renders the body fluid and moist', literally 'is fluid and moistening in the body' (86d4–5).

[59] *Tim.* 86e5–87a2; cf. the explanation of epilepsy as the disruption of 'the most divine circuits in the head' by a pent-up combination of white and black bile (85a–b, esp. a6–7).

[60] As noted earlier, there is a more teleological side to Galen's thinking about the human body, but it is not brought into play in this treatise, including his reading of *Tim.* 86b–87b.

[61] Reydam-Schils 1999 focuses on the idea of successive Stoic readings of the *Timaeus*, Sedley (unpublished) stresses rather the influence of Polemo's version of the *Timaeus* on Zeno. On Socratic and Platonic influence on Stoicism more generally, see e.g. Long 1996, ch. 1; Vander Waerdt 1994, part 2.

[62] For these points of resemblance, cf. *Tim.* 29–30c, 36e–37a with Long and Sedley 1987 (hereafter LS) 54 H–N (references are to sections and passages); also cf. *Tim.* 73e–76d, esp. 75b–c, with Gellius 7.1.7, Cicero *N.D.* 2.142–6 (and, further, Reydam-Schils 1999, 73–8).

[63] Cf. *Tim.* 47b–d, 90a–d, with Cicero *N.D.* 2.37–9, 133, 140, 145, 153–5.

[64] Gill 1997, referring esp. to *Tim.* 69–72 and to the evidence for Stoic thinking in Galen *PHP*.

[65] The combination of a round head and elongated body is seen as teleologically designed to enable the synthesis of these two types of motion; see *Tim.* 69d–e, 73c–d; also 43a–44c, 89e–90d, 91e–92a and Johansen (forthcoming).

[66] See LS 45 and 53; Long 1996, ch. 10.

[67] See further Reydam-Schils 1999, 44–5, Sedley (unpublished), both referring to Theophrastus, fr. 230 (Fortenbaugh et al. 1992); on Stoic principles, see LS 44.

[68] On this Stoic idea, see Inwood 1985, chs. 2–3, Brennan 1998; and on possible Platonic influence here, Gill 1998.

[69] *Tim.* 35a–37c, esp. 36e; and, for comparable Stoic ideas, LS 47 R(3), 53 B(5–6). Note also Posidonius' reported view that the world-psyche in the *Timaeus* is 'the form of what is everywhere extended, constituted according to number that constitutes harmony' (Plutarch *Mor.* 1023b).

[70] There are, for instance, references to the idea of an immortal psyche at *Tim.* 41c–d and 42b, although one that is in some way integrated into a mortal body (42e–43a, 69c–e).

[71] See e.g. LS 65 L, R, S; on Plato, see Mackenzie (1981), 158–78, summarized above.

[72] For an extended discussion (from Galen's standpoint) of this comparison, see *PHP* 5.2.1–51. For a fresh assessment of Galen's evidence on the Stoic theory of passions, see Cooper 1998, Gill 1998.

[73] See e.g. LS 65 C–D, J–K. See further Inwood 1985, ch. 5; Brennan 1998.

[74] Reydam-Schils 1999, 60–9, referring especially to *Tim.* 43a–44c.

[75] Mackenzie 1980, part 3, summarized.

[76] See e.g. Epictetus *Diss.* 1.28, esp. 10; M. Aurelius. *Med.* 2.1, 12.24, 26; also Long 1996, 275–81. The Stoic understanding of vice as 'folly' and 'madness' corresponds to the typology of *Tim.* 86b, though it need not be based on this one Platonic text.

[77] See Plato *Tim.* 86b–87b, also 24c1–9 and *Laws* 747d, the latter two noted by Galen in *Capacities*, ch. 9 (806–7); see also his chs. 6, 10. For the Stoic view, see especially Cicero *De fato* 7–8 (excerpts in LS 55 Q), a view also noted by Galen, loc. cit., ch. 4 (784).

[78] LS 61 L (the LS translation modified).

[79] See Bobzien 1998, ch. 6, esp. 276–90, on moral responsibility, and 290–301, on character-development; also ch. 8 on the contrast with later Peripatetic thought. For some key texts, see LS 62. On the theory, its psychophysical assumptions, and on a possible Platonic prototype (Socrates in Plato *Phaedo* 96–9), see Sedley 1993.

[80] *Tim.* 86d–e, 87b, esp. 87b4–6.

[81] *Tim.* 87c–90d, esp. 87c1–3, 87e5–6, 88a–b, 89e–90a, 90d, and also the above discussion.

[82] i.e. hypersexuality, 86c3–d5, and excess of humor and bile, 86e5–87a7.
[83] For this role, see *Tim.* 69d–70d, compared with the Stoic model discussed in Gill 1997; also *Tim.* 90a–d.
[84] On Cornford and Taylor, see Section I above; also Section II on Galen.

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5

TIMAEUS ON MUSIC AND THE LIVER

Andrew Barker

There is no single, full-scale discussion of sound and hearing in the *Timaeus*. The topics emerge in occasional paragraphs here and there, among wider examinations of perceptible objects, the means by which we perceive them and the functions which these perceptions serve. These passages do not treat all aspects of the subject even-handedly; they repeatedly turn their attention to one very special aspect of the auditory domain, that which consists in musical sound and musical hearing. Even the brief account of sound and hearing in general, at *Timaeus* 67a–c, lists as attributes of sounds only those relevant to music (pitch, 'evenness' and volume) and explicitly points forward to a later study of συμφωνία – *symphōnia*, 'concordance'.

The reason for this focus on musical sound is given at *Timaeus* 47c–e. Timaeus has just explained that the principal function of sight is to allow us to observe 'the revolutions (περίοδοι) of mind in the heavens', and to 'apply them to the cycles (περιφοραί) of our own intelligence, which are akin to them', so that we can come to 'imitate the absolutely unwavering cycles of the god, and stabilize our own wandering ones' (47b–c). Sound (φωνή–*phōnē*, not necessarily restricted to 'voice') and hearing, he continues, are given us for the same purpose. The greatest contribution in this auditory dimension is made by speech (λόγος, 47c6–7); but on that subject Timaeus says no more. Instead he turns to sound in its musical aspect, stating and elaborating the thesis that 'so much of μουσική (*mousikē*) as is adapted to sound in relation to the hearing is given for the sake of ἁρμονία (*harmonia*)'. The movements of *harmonia* are akin to the revolutions of the soul in us, and 'for people who attend intelligently to the Muses, it is not given for the sake of irrational pleasure, as is nowadays thought, but is given by the Muses as an ally for the soul in bringing its revolution in us, which has become unharmonious (ἀνάρμοστον), into order and concord with itself' (47d2–7).

All this needs to be related, of course, to the account of the construction

of the world soul at *Timaeus* 34b–36d, where the mathematical relations between its parts are represented as identical with those of a vast musical scale, or system of musical attunement. In principle, the organization of our own rational soul is the same; but it has become distorted and disordered through its connection with the flow of sensation (43c–44a). The harmonious movements of the world soul and its cosmic body cannot be heard – or not by our ears – although they are made perceptible in the visible rotations of the stars and planets. But the orderly rationality inherent in them can be presented indirectly to our hearing through the music we make ourselves, since the principles underlying the mathematical structure of the world soul are the same as those governing the structure of a well-formed musical system. Both structures are manifestations of the same intelligible pattern of pure 'orderliness' or 'harmony'. To put it another way, what Timaeus calls *mousikē* is a much more inclusive and more abstract category than 'music' in the familiar sense: 'music' here is merely one of the manifestations of *mousikē*. That is why he speaks, in the passage quoted above, of ὅσον...μουσικῆς φωνῇ χρήσιμον πρὸς ἀκοήν ('so much of *mousikē* as is useful for voice in relation to hearing', 47c7–d1). The phrase serves to mark off perceptible music from the rest of the wider domain of *mousikē* in which it is included, and which is essentially constituted by appropriate patterns of mathematical order.

This paper does not set out to analyse these mathematical structures, or to investigate the nature of their special 'harmoniousness' and its relation to rationality.[1] Its project is to consider the processes by which music impinges upon the soul, especially those involving movements inside our own bodies, and the ways in which the soul apprehends it; and to identify among them the transactions through which music can be instrumental in promoting the return of our psychic 'revolutions' to their proper order. What exactly is happening in the soul and the body of a person who 'attends intelligently to the Muses'? The enquiry will range over questions about the physics of sound, the psychology and physiology of perception, the roles of the rational and non-rational parts of the soul in the intelligent and therapeutic reception of music and the interactions between them.

A very brief and summary account of the nature of sound and hearing is given at *Timaeus* 67a–c. Sound (*phōnē*), we are told, is 'an impact made through the ears upon the brain and blood by the air, reaching as far as the soul'. Hearing is 'the movement caused by this impact, beginning from the head, and ending in the region of the liver' (67b2–5).

Several points need emphasis here. First, it appears that nothing will count as sound until it has entered the body in an appropriate way.

Outside us there must be movements in or of the air, caused by impacts of bodies on one another and on the air itself.[2] It is from them that the impulse entering our ears originates. But these, by the definition offered, are not yet sounds. They are merely movements, which become sounds only when they arrive at the soul, after travelling through the medium of ears, blood and brain. Secondly, then, sound itself consists in the impact made 'on the brain and blood, reaching to the soul (μέχρι ψυχῆς)'. But this is not the familiar thesis that a movement or impact can count as a sound only when it is perceived as such, since the part of the soul housed in the area of the brain is not the part responsible for perception. The two are quite radically distinguished, and their locations are separated and as far as possible insulated from one another (69d–70a, cf. 44d). It is the rational soul that is located in the head; and it is when it impinges on this rational soul that an impact becomes a sound. Timaeus must apparently conceive of the impact as affecting the motions of this soul in some way, although no direct account of its reaction is offered; but it does not yet affect it as something *heard*.

Hearing occurs when the movement caused by the impact is transmitted from the head to the liver. The liver is associated with that aspect of the lowest part of the soul which is concerned with perception (71a–b), the whole of this lowest part being billeted in the general area of the abdomen, below the diaphragm (69e–70a, 70d–e). We shall consider the special role of the liver later. For the present the central point is that the movement constituting hearing is a secondary one, the immediate origin of which is in the head, not in the external source. The effects of the impact upon our ears must first pass through the brain, thereby (presumably) affecting the rational soul; and it is the consequent movement of the rational soul, not that of the air or the eardrum, which is passed on to the liver and experienced as hearing.

The passage continues with a quick-fire analysis of three acoustically and musically important attributes. Pitch depends on swiftness of movement, smoothness and roughness on its evenness or unevenness, volume on its bulk (67b6–c1). These correlations are unsurprising.[3] What is much more remarkable is that the grammar and syntax of the passage ensure that the movement to which these attributes attach is not that constitutive of sound, but the one identified with hearing; this is shown by the feminine accusative forms in which the adjectives naming the attributes appear, in agreement with ἀκοή (*akoē*– 'hearing') at the end of the previous clause.[4] It is hearing, then, not sound, that can be high-pitched or low, smooth or rough, loud or quiet. Strange though that may seem, it is essential if Timaeus' account is to remain consistent. These

attributes belong strictly to the auditory domain, and characterize what we might call 'objects of hearing'. They cannot be attributes of 'sound' as it is conceived in this passage, since that is a movement between ear and brain, and makes no direct contact with the organ of perception. Pitch, loudness and so on can qualify only what is heard, and this cannot be the unperceived 'sound'. But neither, it appears, is it properly to be conceived as an 'object' of hearing. It is rather the movement that constitutes hearing itself. Timaeus does not say that the movement between head and liver is the object of the hearing that takes place in the region of the liver, or that it is causally responsible for hearing; he says that this movement *is* hearing. Hearing then, not sound or the object of hearing, is that which can possess the characteristics normally attributed to audible music. The fact that we are deliberately being led by this list of attributes to the subject of music is underlined in the final sentence of the passage (67c2–3), in which Timaeus promises to address the topic of 'their concordance' (περὶ συμφωνίας αὐτῶν) at a later stage.[5] We should note that the only possible reference of the word αὐτῶν, 'their', is again not to sounds, but to instances of hearing.

Timaeus keeps his promise. The section on concordance is at *Timaeus* 80a–b, embedded in a discussion of the way in which movement, in general and in various different manifestations, can be understood without postulating the existence of empty space. As a special example of movement Timaeus mentions 'notes' (φθόγγοι – *phthongoi*), characterizing them as swift or slow, and explaining once again that those which are swift 'appear' (φαίνονται) high-pitched, and those that are slow appear low-pitched. It is not clear from this opening clause alone whether the *phthongoi* are conceived as movements external to us transmitted through the air from musical instruments, or as 'sounds' or as 'hearings', as these are represented at *Timaeus* 67b. Perfect clarity on this issue is not achieved even in the second part of the sentence; but it does at least locate the phenomenon of musical concordance unambiguously inside us. The swift and slow *phthongoi* 'sometimes travel in disharmony (ἀνάρμοστοι) because of the dissimilarity (or perhaps 'unevenness', ἀνομοιότης) of the movement set up by them inside us, sometimes in concord (σύμφωνοι – *sumphōnoi*) because of its similarity (or 'evenness', ὁμοιότης)'.[6] Here the *phthongoi* are treated as responsible for the movement occurring in us (τῆς ἐν ἡμῖν ὑπ' αὐτῶν κινήσεως) rather than being identical with it, so that we might suppose that they are movements external to the body. On the other hand it is they that are said to travel in disharmony or in concord *because of* the dissimilarity (ἀνομοιότης) or similarity (ὁμοιότης) of the movement in us, which can hardly be true unless they are themselves

those internal movements. The name φθόγγος (*phthongos*), in fact, seems to be attached to all phases of the movement, from its external source to its destination at the liver; but the phenomena of disharmony and concord are internal only.

Timaeus now offers an explanation of what is meant by the 'similarity' of the movements of a swifter and a slower *phthongos*, when they are concordant, and of the process by which it comes about. Swifter *phthongoi* arrive earlier, but their movement fades; and as it is fading they are caught up by slower ones. By this time the speed of movement of the swifter *phthongoi* has slowed down to the same pace (ἤδη τε εἰς ὅμοιον ἐληλυθυίας) as that of the slower movements when the latter arrive; and as the slower movements catch them up 'they do not disturb their motion by imparting a different one, but impart the beginning of a slower motion in conformity with that of the swifter, now that the latter is fading. By attaching a similarity (ὁμοιότης) they blend together a single experience (μία...πάθη) out of high-pitched and low-pitched movement' (80a6–b5).

The general character of the process that Timaeus envisages is clear enough; but it would be hard – perhaps impossible – to provide a plausible and consistent analysis of its details. However the category of 'concordant *phthongoi*' is conceived, it must include pairs of notes whose pitches are related in several different ways, since 'concordance', on any Greek account of that attribute, is a feature of intervals of several different sizes. The speeds of the movements of their constituent notes therefore stand to one another in any of several different ratios. The external origin of the impulses that give rise to the *phthongoi* may presumably be located at any distance, within broad limits, from the ear of the perceiver. Given those facts, I have found, and can devise, no physical and mathematical model of the transmission of their 'fading' movements which will allow the conditions posited by Timaeus' description to be satisfied for all cases. No matter. What is important for our purposes is that the location at which the slower sound catches up with the swifter, and the relation of concordance is actualized, is somewhere inside our own bodies. The same must evidently be true of the converse attribute ἀναρμοστία (*anharmostia*, which may be either 'discordance' or 'unharmoniousness', 'lack of musicality'; the issue will be discussed below). The present passage is in this respect fully consistent with *Timaeus* 67b–c.

The discussion of concordance (συμφωνία) is embedded, as I have said, in a general account of movement, which focuses on the question of how movement is possible when the existence of empty space, which would allow passage for the moving object, is denied.[7] The hypothesis adopted, and linked to a wide variety of instances, is that of 'circular replacement',

a notion that apparently originated with Empedocles.[8] A moving object must push away whatever lies in its path; that in turn pushes another, until the continuous shunting completes the circle and moves other matter into the place where the first initially was. That is a slightly misleading way of putting it, however. The transmission of all this movement is simultaneous, not successive, and the various parcels of matter are fully continuous with one another, so that there is never a time when the place left by the first object, or by any of the objects, is empty. Timaeus introduces the topic of *phthongoi* and their movements as an example of this process; yet nothing is said explicitly to show how they exemplify it. The slower movements that catch up with the swifter are not elements in the cycle induced by the movements of the swifter. They have different external origins (the plucking of a different string, for example), and they catch up with the swifter movements at a time later than that at which the swifter were initiated.

Nevertheless the proposition that the movements of these *phthongoi* exemplify the cyclic theory of motion is essential to the overall context. The exclusive attention paid by the passage to movements inside our bodies strongly suggests that the cycle itself, in this case, is to be conceived as internal; Timaeus appears to have no interest at all in the external movements from which those involved in hearing arise. Since the movement constituting hearing runs, as we have been told, from the head to the liver, we may reasonably guess at the implication that it is accompanied by a converse flow of movement in the opposite direction. When we hear, and specifically when we hear music, movement is transmitted from brain to liver and simultaneously, as a consequence, from liver to brain. I shall return to this suggestion later.

Meanwhile, a further issue arises in the interpretation of the lines we have been studying. They distinguish συμφωνία (*sumphōnia*, which we have been translating as 'concordance') from ἀναρμοστία (*anharmostia*, which we have so far left hovering between 'discordance' and 'lack of musicality'); but what exactly are these? In technical musicological writings, the term *sumphōnia* has a quite specific meaning. It refers to a special relationship which is manifested in perfect fourths, perfect fifths and octaves, in combinations of the octave with any other *sumphōnia*, and nowhere else.[9] In mathematical harmonics, especially in the 'Pythagorean' tradition, the peculiar excellence of the primary 'concords' is displayed in the elegance and simplicity of the ratios corresponding to them, 2:1 for the octave, 3:2 for the fifth, 4:3 for the fourth, all of whose terms are embraced within what is known as the *tetraktus* of the decad.[10] The thesis that this technical sense of *sumphōnia* is intended in the present passage is supported by

Timaeus' statement that 'concordant' *phthongoi* blend with one another to generate a 'single experience'. This is precisely the way in which later authors describe the impression made on us when pairs of notes related in the fourth, fifth or octave are played or sung simultaneously. They blend together, in our perception of them, and are grasped by the hearing as a single, unified phenomenon. Pairs of notes that are 'discordant' (διάφωνοι) with one another, by contrast, do not blend in this way, and are perceived as two distinct items.[11]

But there are difficulties in this reading of the passage. Not all musical relations are concords in this sense. The majority, in fact, are not; and there is a further distinction to be drawn between musical or 'well-attuned' relations in general, and those that are non-musical or 'ill-attuned'. Now in Timaeus' account, the converse of σύμφωνος (*sumphōnos*) is not διάφωνος (*diaphōnos*, the regular term for 'discordant', in a sense that includes musical but non-concordant relations), but ἀνάρμοστος (*anharmostos*), and this is the standard word used to mean 'ill attuned', 'not proper to any well formed pattern of musical attunement (ἁρμονία–*harmonia*)'.[12] For a Greek writer to describe some musical intervals as *diaphōna* is normal; to describe anything admissible in music as *anharmostos* would be linguistically impossible, or at best a deliberate paradox with a special agenda of its own.

Further, when (at 80a5–8) Timaeus goes on to say that *sumphōnia* 'provides pleasure (ἡδονή) for the unintelligent, but delight (εὐφροσύνη) to the intelligent, because of its imitation of the divine *harmonia* in mortal movements' it is natural to suppose that he is talking about music, not the mere perception of isolated concordances. Pairings of simultaneous but different notes played only a minor role in Greek music-making. Its appeal depended fundamentally on rhythm and melody, not on the qualities of 'chords', in the modern sense of that word. Again, it is music, not concordant pairings of sounds bereft of melodic context, that is regularly regarded as *mimēsis* (μίμησις);[13] and even if the 'divine *harmonia*' mentioned here is a formal structure, a pattern of attunement rather than a melody (which cannot be regarded as certain), it is clear from the account of the 'harmonic' structure of the world soul that many of its defining relations are musical discords.

On the other hand, it seems impossible to interpret Timaeus' physical explanation of *sumphōnia* as being concerned with anything other than the 'concordance', in that word's technical sense, of certain pairs of sounds which are transmitted from their origin simultaneously. The language of 'blending' points insistently in the same direction. We can hardly avoid the conclusion that the passage is an unsatisfactory fusion of two projects

that are essentially distinct, one designed to provide a scientific basis for the contrast between concord and discord, the other concerned with the distinction between musical and non-musical relations. It is worth noting that similar uncertainties arise over a related passage of the *Republic*. Here Socrates had specified the task of harmonics (in the highly abstract mathematical guise he imagines for it) as that of 'investigating which numbers are *sumphōnoi* and which are not, and in each case why' (*Rep.* 531c3–4). This enterprise is represented as extraordinary and difficult (δαιμόνιον...πρᾶγμα, 531c5); and no doubt the business of explaining why certain mathematical ratios are 'concordant' and others are not raises intellectual problems of a tough order. But if 'the numbers that are *sumphōnoi*' are those pairs of numbers that correspond to musical concords in the technical sense, the task of finding out 'which numbers are *sumphōnoi* and which are not' is not only easy, but had long since been completed.[14] What might very well be represented as an intractable task is that of identifying, as numerical ratios, the relations holding between all pairs of adjacent pitches in all acceptable forms of musical scale or attunement. This is a project that was being attempted in Plato's time,[15] and it was indeed highly problematic. The procedures appropriate to the enquiry, and the correct mathematical conclusions, continued to be matters of intricate debate for centuries afterwards. Despite the technicality of its context, then, it is probable that *sumphōnos* in this passage of the *Republic* does not mean 'concordant', but 'musically acceptable in the framework of a melodic system'.

Regardless of the intrusive analysis of 'concord' at *Timaeus* 80a6–b5, I propose to proceed on the assumption that the dominant contrast in the passage as a whole is between the unmusical or ill-attuned (ἀνάρμοστος) and the musical, and that it is music, not concord, which provides 'pleasure' or 'delight' and is a μίμησις (*mimēsis*) of the divine ἁρμονία (*harmonia*). The reverberations of the excursus on concord, and the reference to the divine *harmonia*, play their part by ensuring that the musicality of well formed pitch-relations is conceived as an objective attribute susceptible of scientific and mathematical description; it is not dependent merely on accidents of convention or taste. But this brings us to the last group of problems I shall consider. The movements constitutive of hearing are musical when they are related in special ways that can be analysed in terms proper to physics and mathematics. But it is not in that guise that we perceive them and appreciate them as music. We do not hear a melody as a sequence of movements whose speeds and interactions fall into recognizable mathematical patterns. At the very least, it is plainly not under that description that music gives 'pleasure to the unintelligent'.

It is easy to put these points negatively, but much harder to express positively the aesthetic content of our experience of musical melody, and the ways in which it is perceived as differing from a non-musical sequence of sounds. We need to enquire whether Timaeus has anything to say on this issue. We would also like to be told how perceptual experiences of this sort are derived from episodes of 'hearing' which, from an objective point of view, are merely mathematically ordered patterns of movement. Finally, we should ask how we are to understand the special contribution made by 'intelligent' listeners, and through what processes their experience of music, unlike that of others, becomes a source of delight (εὐφροσύνη) 'because of its imitation of the divine *harmonia* in mortal movements'.

We cannot anticipate full and clear answers to all, or perhaps any, of these questions. But there is one passage of the *Timaeus* which provides significant clues, if it is taken in conjunction with those we have already considered. This proviso is necessary, since the passage itself (70d–72b) says nothing about sound or hearing. We shall have to extrapolate, perhaps riskily, from one context to another. The thread linking the two contexts is a bodily organ, the liver.

The lowest part of the soul is housed in the abdomen, where it fulfils its role in the bodily economy as the source of desires for food, drink and the like. It is tied up there like a wild beast, a potentially disruptive element whose 'uproar and shouting' are to be kept as far as possible from the seat of thought and deliberation. It has no understanding of *logos* (here 'reason'), and even when it gains some awareness (αἴσθησις) of such things it is not in its nature to take any notice of them (70d7–71a5).

It is influenced, instead, by 'images (εἴδωλα – *eidōla*) and phantasms (φαντάσματα – *phantasmata*); and the gods decided to use this fact for a worthwhile purpose. They did so by 'putting together with it the liver, and placing the liver in its dwelling-place' (71a5–b1). By making the liver dense and smooth and shiny, and including both bitterness and sweetness in its make-up, the gods enabled it to serve as a mirror which reflects 'the power of thoughts, transmitted from the mind', receiving these thoughts as *tupoi* (τύποι – we shall consider the meaning of this word shortly) and emitting them again as *eidōla* (71b2–5). Timaeus offers an elaborate piece of physiological rhetoric to convey the manner in which harsh and threatening thoughts activate the bitter element in the liver, producing roughness, distortion and discoloration, and inspiring terror and distress in the irrational soul; and how gentle thoughts activate the liver's sweetness, making everything 'proper and smooth and free', painting pleasing *phantasmata* and 'making the part of the soul that inhabits the region of the liver cheerful and happy' (71b5–d1).

This part of the passage provides the principal clue to the manner in which music presents itself to the part of the soul responsible for perception and emotion. Hearing, like thought, is transmitted as a movement between the head and the liver. The liver is plainly not identical with the lowest part of the soul, nor does it seem to be its bodily container – which is specified, rather broadly, as the area between the diaphragm and the navel (70d8–e1). The liver is made 'adjacent to it', or perhaps 'connected with it'.[16] As a consequence, the perceptive soul can act as a receptor for anything that is reflected from the liver's smooth surface.

If the present passage is a reliable guide, then, the movements of hearing impinge on the liver as *tupoi* (τύποι) and are reflected from it to the lower soul as *eidōla* (εἴδωλα). Timaeus does not elucidate the distinction between *tupoi* and *eidōla*, but for the special case of musical hearing it may perhaps be tentatively reconstructed. A *tupos*, in its most straightforward usage, is the impression made by one thing on another through pressure or impact, as for example the impression of a seal-stone in wax. Hearing has been analysed as a movement, or a set of movements, whose salient musical characteristics consist in the speeds of these movements and the relations between them. It is then the pattern formed by this system of movements that impresses itself on the liver as a *tupos*.

What is reflected from the liver is no longer a *tupos* (τύπος) but an *eidōlon* (εἴδωλον) or a *phantasma* (φάντασμα), and it is clear that these 'images', which carry a powerful emotive charge, are conceived representationally, as 'pictures'. We are not told how the magical transformation of *tupoi* into *eidōla* is achieved. But the representational character of the *eidōla* fits squarely with a constant refrain in Plato's writings on music, that all of it is essentially *mimēsis*. The object 'imitated' by music seems to be variously conceived in different passages; sometimes it is another perceptible item (as at *Republic* 399a5–8, cf. 397a3–7), sometimes, more abstractly, a good or bad character (e.g. *Republic* 401b1–3, *Laws* 655d5). But it is always *mimēsis*. The thesis is most explicitly and emphatically stated in the *Laws*, at 668a6–7, b9–c2, 798d7–9.

When we perceive a sequence of sounds as music, then, we perceive them not in their own character as quantifiable movements or impulses, but as *mimēseis* of other things, analogous to pictures; and these *mimēseis* give pleasure. Just so, in the *Timaeus*, the movements constitutive of hearing are reflected from the liver to the non-rational soul as *eidōla*. When the movements producing the *tupoi* from which the *eidōla* originate bear 'gentle' or 'favourable' messages from the mind, the *eidōla* are a source of happiness and enjoyment for the lower soul. Where these movements are those of hearing, we may suppose, the movements of

musical melodies will be prominent among those whose *tupoi* are reflected as enjoyable *eidōla*.

We still have to discover how an intelligent listener can move beyond the mere enjoyment of *eidōla* (εἴδωλα) to a higher delight in music's *mimēsis* (μίμησις) of the divine *harmonia* (ἁρμονία). The music which such a listener appreciates is still conceived as *mimēsis*, but its object is no longer human utterance or action or character. It is a complete and paradigmatic perfection that lies outside our mortal experience, and can be fully grasped only in thought. To shed some light on the transition between these modes of experience, we must return once more to Timaeus' account of the liver.

When the lower soul is in a state of enjoyment, induced by pleasing *eidōla*, it can pass its nights peacefully; and though it has no share in *logos* or *phronēsis*, it can exercise, in sleep, the power of *manteia* (roughly 'inspired divination', *Tim.* 71d1–4). This 'mantic' power is given to mortal nature so that, despite its incapacity for rational thought, even the worst part of us may come into contact, somehow or other, with truth (71d5–e2). Timaeus does not confine to sleep alone the occasions on which this capacity, *mantikē*, can be exercised. He insists, at 71a2–6, that 'true and divinely inspired' *mantikē* can occur only when the rational mind is disengaged; but this may be in sleep, or as the result of illness, or through the frenzies of *enthousiasmos* ('ecstatic possession') .

There are of course familiar links between music's enchantments and *enthousiasmos*, and Plato exploits them for different purposes elsewhere (e.g. *Ion* 533e3–34a7). If we accept that in being captivated by music we are taken 'out of our minds' in the way Timaeus requires, we shall conclude that just as we dimly perceive, in the *eidōla* of mantic dreams, the aura of divine significance, so too the experience of musical *mimēseis* inspires cloudy intimations of loftier meaning.

But *mantikē* does not interpret itself. Its expression is confined to obscure oracular utterances or ravings, and while we are in the mantic state we ourselves cannot understand them. Understanding is the task of a person 'in his right mind' (ἔμφρων). All the words uttered and all the *phantasmata* seen through the power of *mantikē* in a condition of *enthousiasmos* must be submitted to rational analysis (λογίσμῳ διελέσθαι) if their significance is to be recovered (71e2–72a6). This task of interpretation belongs not to the *mantis* (ὁ μάντις) but to the *prophētēs* (ὁ προφήτης), two classes of person whom Timaeus takes pains to distinguish (72a6–b5).

If the analogy with music can still legitimately be pursued, there should be a mode of rational analysis, corresponding to the 'interpretations' of the *prophētēs*, through which the true significance of musical 'images'

can be revealed. And of course there is. It is the science of mathematical harmonics, which appears in the *Republic* as the fifth and highest of the mathematical disciplines which guide the fledgling philosopher towards a dialectical understanding of the Good (*Rep.* 530c8–531d6). I cannot go into its details here. Very broadly, the task of the science, as Socrates conceives it, is to identify the 'concordant' or 'musical' systems of numbers which we discussed earlier, to articulate the patterns of 'harmonious' relations which hold between their members, and to grasp the principles on which the special excellence of their relations rests. The fact that the status of this science and the outline of its programme have not significantly changed between the *Republic* and the *Timaeus* is plain from the uses made of its methods and conclusions in the analysis of the world soul, that most admirable of structures. Its musical-mathematical organization and the principles of harmonic order underlying it belong precisely to the class of truths that the *Republic*'s harmonic science is designed to reveal.

This capacity for mathematical analysis must be closely related to the 'intelligence' of the listeners referred to at *Timaeus* 47d3 and 80b6. But although pursuit of harmonic science and contemplation of its conclusions, in so far as they display the structure of the divine *harmonia*, may well be a source of 'delight' to such people, it is surely not quite identical with the 'delight' (εὐφροσύνη) which is mentioned at 80b6. Both here and at 47d4–7, the benefits of music for the intelligent listener appear to arise in the presence of music itself, in the act of listening, not in the detached contemplation of mathematical theorems in the silence of private study. We should look for an account of the way in which music experienced imagistically in the lower part of the soul can also be received and appreciated 'intelligently' by the rational mind.

The passage at *Timaeus* 67a7–c3 which we reviewed suggests two possible models. We discover, first, that sound consists in the transmission of an impact from the ear to the soul in the region of the brain. One might speculate then that the rational soul's appreciation of musical sound occurs in this phase of the process of reception. Secondly, however, the passage goes on to treat hearing as a movement passed on from the head to the region of the liver. At 80a3–b8, the passage on 'concordance' is embedded in an exposition of the cyclic theory of motion; and, as I remarked earlier, this seems to imply that the movement constituting hearing must be completed by a return of the same movement to its origin in the head. Hence the reception and appreciation of music in the rational soul may belong to this second stage of the process, rather than the first.

If Timaeus has any view on this matter, it is more likely to correspond to the second of these models, for at least two reasons. First, the accounts

of musical attributes at 67b6–c1, and of *sumphōnia* at 80a3–b5, attach these features to the movement constituting hearing, not that constituting sound. The latter passage, in particular, seems to suggest that *sumphōnia* arises only in the movement of hearing, since it is apparently only there that the slower motions catch up with and blend with the swifter in the appropriate way. Secondly, the discussion of *mantikē* at 71e1–72b5 indicates that the work of interpretation is subsequent to that of mantic *enthousiasmos*, and that what the *prophētēs* subjects to rational analysis is something already represented in *phantasmata* or *eidōla*, reflected from the liver to the lower part of the soul.

If we put these two points together, we may conclude that as the movement of hearing, with its musical attributes, pursues its circular route from head to liver and back again, it passes from the liver to the lower soul in the guise of mimetic *eidōla*, and from there back to the head in the form of responses made by the lower soul to the arousal of these images in it. It is these mantic responses that alert the intelligence to the presence of something that calls for interpretation. But since the 'message' transmitted still retains the physical form of harmonious movement, the rational soul is presented, in the same event, with materials which it can construe within the framework provided by mathematical harmonics, and in which it can find *mimēseis* of the divine *harmonia*. The 'intelligence' of appropriate listeners consists in their grasp of the necessary science; and their interpretation of the lower soul's intoxicated intuitions arises in their passage through the analytic prism of mathematical understanding.

This completes the cycle of the movement of hearing from head to liver and from liver to head; and it also completes our survey of this enigmatic byway in Plato's writing. I make no apologies for its fitfully speculative character. Timaeus' statements, in their own way, are as mantic as the impressions conveyed by any musical *phantasmata*, and, unlike the harmonic theorist, I have no key that will unlock their secrets by the application of pure *logismos*. But we may end on a soberer note. Later Greek scholars, reviewing the position taken by exponents of 'Pythagorean' harmonics, frequently refer to their claim to base their analyses on reason alone, and not to rely at all on perception. The regular comment is that this posture is misleading; harmonic investigation must inevitably take its starting point, at least, from the data of musical hearing, since nothing else can provide the object on which rational analysis is initially exercised.[17] In the *Laws* Plato's Athenian Visitor seems to have a similar point in mind when he insists that sound musical judgement depends partly on scientific understanding, but partly also on 'acute perception' (εὐαισθήτως ἔχειν, 670b3). The reconstruction I have offered of the transactions between

perception and reason that are sketched in the *Timaeus* suggests that Plato took this idea one small but significant step further. He understood that musical perception does not consist merely – as the later commentators I have mentioned imply – in the recognition of pitch-relations as concordant or discordant, musical or unmusical, but embraces an altogether more impressionistic and enigmatic realm of imagery and emotional response. It is these dream-like phantasms, not just the directly perceived qualities of objective acoustic relationships, that the intelligent listener must rationally and 'prophetically' interpret.

Notes

[1] Some notes on the mathematics are provided in Barker 1989, 59–61. On the 'rationality' of Plato's mathematics in general, see especially Burnyeat 1987. Certain aspects of the matter which are relevant to the *Timaeus* are considered in Barker 1994.

[2] See for instance Archytas fr. 1, [Aristotle] *De Audibilibus* 800a, [Euclid] *Sectio Canonis* 148.2–6.

[3] The associations of pitch with swiftness of movement and of volume with the bulk of air moved are common in Greek sources; for details see Barker 1989, 41, footnotes 47–48. On rough and smooth sounds see [Aristotle] *De Audibilibus* 803b.

[4] τὴν δὲ ὑπ' αὐτῆς κίνησιν, ἀπὸ τῆς κεφαλῆς μὲν ἀρχομένην, τελευτῶσαν δὲ περὶ τὴν τοῦ ἥπατος ἕδραν, ἀκοήν· ὅση δ' αὐτῆς ταχεῖα, ὀξεῖαν, ὅση δε βραδυτέρα, βαρυτέραν· τὴν δὲ ὁμοίαν ὁμαλήν τε καὶ λείαν, τὴν δὲ ἐναντίαν τραχεῖαν. ('...[let us state that] the movement generated by [sound], beginning from the head and ending in the region of the liver, is hearing; and as much of it as is swift is high-pitched, and as much as is slower is lower-pitched; that which is all alike is even and smooth, while the opposite kind is rough...') *Tim.* 67b4–c1.

[5] τὰ δὲ περὶ συμφωνίας αὐτῶν ἐν τοῖς ὕστερον λεχθησομένοις ἀνάγκη ῥηθῆναι. ('It will be necessary to speak in a later passage about matters to do with their concordance.') *Tim.* 67c2–3.

[6] *Tim.* 80a4–6. We may note that Plato describes the movement of a 'smooth' sound in a similar way at 67b, as ὁμοίαν <κίνησιν>. The present passage shares a good deal of its terminology with an account of early Pythagorean practices given by Porphyry on the authority of Archytas (Porphyry, *Commentary on the Harmonics of Claudius Ptolemaeus* 107.15–108.21 Düring = DK47 A17).

[7] For the thesis that void is a prerequisite of movement, see e.g. Melissus fr. 7, and in the context of atomism see Aristotle, *Metaph.* 985b4 ff. and *De Caelo* 300b8 ff.

[8] See Empedocles frs. 13 and 100.

[9] See for instance Aristoxenus *El. Harm.* 45.7–33, [Euclid] *Sectio Canonis* Proposition 12, Theon Smyrnaeus 51.1–52.8.

[10] Relevant passages include Philolaus fr. 6, schol. to Plato *Phaedo* 108d4 (= DK18.12), Theon Smyrnaeus 59.4–21 (= DK 18.13), Sextus Empiricus *Adv. Math.* 7.94–5. Note also the primacy given to these ratios in the account in the *Timaeus* of the structure of the world soul.

[11] For references see Barker 1989, 409 n. 58.

[12] See e.g. Aristoxenus *El. Harm.* 18.28–9.1, 52.24–5.

[13] e.g. Plato *Laws* 668a–c, and especially [Aristotle] *Problems* 19.27.

[14] See for instance the passages cited in n. 9 above.

[15] The most significant figure in this connection was Plato's friend Archytas of Tarentum. Details are recorded at Ptolemy, *Harmonics* 30.9–31.18 Düring = DK47 A16.

[16] 71a7–b1: θεὸς...τὴν ἥπατος ἰδέαν συνέστησε καὶ ἔθηκεν εἰς τὴν ἐκείνου κατοίκησιν – 'the god...constructed the form of the liver and placed it *eis* (adjacent to / connected with) the dwelling of [the lowest part of the soul]'.

[17] See particularly the comments of two writers quoted by Porphyry in his *Commentary on the Harmonics of Claudius Ptolemaeus*: Ptolemaïs of Cyrene at 25.10–14, Didymus at 26.15–25.

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6

ARISTOTLE'S UNDERSTANDING OF PLATO'S RECEPTACLE AND ITS SIGNIFICANCE FOR ARISTOTLE'S THEORY OF FAMILIAL RESEMBLANCE

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The frequency with which Aristotle cites the *Timaeus* compared to other Platonic dialogues suggests that he considered it to be one of Plato's most important works,[1] although he is often seen to be critical of it. Cherniss believes that Aristotle criticized Plato for, among other things, failing to regard the featureless Receptacle underlying the generation of particulars as both substrate (ὑποκείμενον–*hypokeimenon*, as applied to the Receptacle a basic material principle) and privation (στέρησις–*sterēsis*, the general negation of form, and in the case of the Receptacle the lack of all sensible qualities); Fine remarks that Aristotle does not approve of the creation of the world in time or of the presence of the demiurge as creator. But the objection noted by Cherniss supports the observation made by Claghorn that Aristotle believed that the Receptacle of the *Timaeus* shared most of the important characteristics of his prime matter.[2] If this were not the case Aristotle would have no cause to criticize Plato for failing to recognize a necessary refinement of the substrate. Similarly, since Aristotle does not believe that the world had a beginning in time (the act of creation which, he believed, required Plato to posit the existence of the Receptacle), Plato's description of how the Receptacle functions must, for Aristotle, connect with the role matter plays in the creation of new entities in this world.[3] In explaining the role of the Receptacle and Forms in producing this world, Plato uses a biological simile of parents and offspring.[4] An examination of this simile, along with Plato's discussion of sexual reproduction at *Timaeus* 91c–d, can shed light on some basic assumptions of reproduction held by both Plato and Aristotle, and this in turn can illuminate the conundrum which has faced modern scholars seeking to explain how, according to Aristotle's theory of sexual reproduction, a child can resemble its mother.

The most important passage for the identification of the Receptacle and prime matter occurs at *De Generatione et Corruptione* 329a9–19, where Aristotle says that those who believe in a single corporeal and *separable* matter as the source of reality are mistaken (ἁμαρτάνουσιν), but with regard to the Receptacle of the *Timaeus* he merely criticizes Plato for not defining it accurately (οὐδένα ἔχει διορισμόν), because Plato did not state clearly (οὐ γὰρ εἴρηκε σαφῶς) whether or not it was separable from the elements. He continues:

> οὐδὲ χρῆται οὐδὲν, φήσας εἶναι ὑποκείμενόν τι τοῖς καλουμένοις στοιχείοις πρότερον, οἷον χρυσὸν τοῖς ἔργοις τοῖς χρυσοῖς. καίτοι καὶ τοῦτο οὐ καλῶς λέγεται τοῦτον τὸν τρόπον λεγόμενον.[5]
>
> Nor does he make any use of it, although he says it is something underlying the so-called elements at an earlier stage, just as gold underlies the objects made of gold. Yet put in this way the statement is not a happy one.

Obviously he thinks that Plato is on the right track in saying that the Receptacle acts as the underlying material for the elements (although the phrase ὑποκείμενόν τι, 'something underlying', is Aristotle's own) just as gold can act as material for any number of different artefacts. Aristotle himself frequently uses similar analogies to represent the relationship of matter to form, but he disagrees with Plato's claim that, rather than giving each of the things that come-to-be a name (however brief their existence), it is safer to call them all 'gold'. Indeed, at *Physics* 190a25 he effectively says the precise opposite of this: 'we speak of a statue coming to be from bronze, not of bronze becoming a statue'. So, although Aristotle does not think that Plato is precise in his articulation of the role of the Receptacle in coming-to-be, he implies that, had Plato defined it more explicitly, it would have been directly comparable with his own conception of prime matter because it underlies everything but cannot exist without being something else.

Although Plato's narrative of the Forms existing separately before the world did was not acceptable to Aristotle, his biological simile of the coming-to-be of particulars in this world at *Timaeus* 50d does parallel that of Aristotle's explanation of sexual reproduction:

> προσεικάσαι πρέπει τὸ μὲν δεχόμενον μητρί, τὸ δ' ὅθεν πατρί, τὴν δὲ μεταξὺ τούτων φύσιν ἐκγόνῳ. νοῆσαί τε ὡς οὐκ ἂν ἄλλως ἐκτυπώματος ἔσεσθαι μέλλοντος ἰδεῖν ποικίλου πάσας ποικιλίας τοῦτ' αὐτὸ ἐν ᾧ ἐκτυπούμενον ἐνίσταται γένοιτ' ἂν παρεσκευασμένον εὖ, πλὴν ἄμορφον ὂν ἐκείνων ἁπασῶν τῶν ἰδεῶν ὅσας μέλλοι δέχεσθαί ποθεν.
>
> It is proper to liken the Recipient to the Mother, the Source to the Father, and what is engendered between these two to the Offspring; and also to perceive that, if the stamped copy is to assume diverse appearances of all sorts, that substance wherein it is set and stamped could not possibly be suited to its purpose unless it were itself devoid of all those forms which it is about to receive from any quarter.

In the *Timaeus* Plato cites only two entities used in the production of particulars/offspring: μητρί ('mother') to refer to the Receptacle and πατρί ('father') to refer to the Forms. In Aristotle's theory of sexual reproduction these are all that are needed to create a new individual, because, in the creation of living entities (substances *par excellence* for Aristotle), the formal, efficient and final causes coalesce in the figure of the father. But this cannot be the case with the Platonic Forms. Cornford says of the imagery of the Forms as father: 'this symbolism...cannot be taken literally – the Forms can possess no generating power'.[6] And at *Metaphysics* 988a8–11 Aristotle criticizes Plato for using only formal and material causes in explaining generation. Aristotle will not countenance the demiurge as efficient cause because (1) he does not believe that the world was created, and (2) he believes natural kinds can only be produced by natural kinds of the same sort. Leaving aside the disagreement between Plato and Aristotle on whether the world had a beginning or not, if we consider *Timaeus* 29d–30c, the passage where the demiurge is first described as bringing order to the inchoate visible world, we can see the demiurge acting almost like the father in the production of Aristotelian natural kinds. The passage in the *Timaeus* begins:

> λέγωμεν δὴ δι' ἥν τινα αἰτίαν γένεσιν καὶ τὸ πᾶν τόδε ὁ ξυνιστὰς ξυνέστησεν. ἀγαθὸς ἦν, ἀγαθῷ δὲ οὐδεὶς περὶ οὐδενὸς οὐδέποτε ἐγγίγνεται φθόνος· τούτου δ' ἐκτὸς ὢν πάντα ὅ τι μάλιστα γενέσθαι ἐβουλήθη παραπλήσια ἑαυτῷ.
>
> Let us now state the cause whereof he that constructed it constructed Becoming and the All. He was good, and in him that is good no envy ariseth ever concerning anything; and, being devoid of envy, he desired that all should be, as far as possible, like unto himself.

As with the reproduction of Aristotelian living beings, the final, formal and efficient causes are the same: the purpose of the production of the world is that it should reproduce as far as possible the one responsible for the production. In describing the action of the demiurge as efficient cause Plato uses the same verb, συνίστημι, which Aristotle uses to signify the first impact of form upon matter. Moreover, the result of the demiurge's actions is a living being (ζῷον ἔμψυχον).

At *Timaeus* 31a–b, directly after he has described the world as a 'living being', Plato poses the question of whether there could be more than one world. His answer, of course, is that there could not, because the living

being (ζῷον ἔμψυχον) of the world embraces all other living creatures, replicating the model in its uniqueness, and, if there were another in addition to it, a more inclusive Form would have to be posited to cover these two living-world Forms. I suggest that what leads Plato to pose the question at this point is not simply a sudden concern with the atomists' theory of multiple worlds, but the basic division of living creatures of most kinds into male and female. That is why Plato frames his argument in terms of the living world not being one of a pair (μεθ' ἑτέρου δεύτερον οὐκ ἄν ποτ' εἴη) rather than its not being part of a multiplicity.[7] He says that if two such worlds did exist and produced this cosmos, this cosmos should still be described as resembling the more inclusive Form rather than the two subsidiary Forms (καὶ οὐκ ἂν ἔτι ἐκείνοιν ἀλλ' ἐκείνῳ τῷ περιέχοντι τόδ' ἂν ἀφωμοιωμένον λέγοιτο ὀρθότερον). Here Plato is offering a counter-argument, based on the necessary uniqueness of the living world, to the objection that as a living creature the world should have more than one progenitor.

All this, of course, does not abrogate the problems of the relationship of the intelligible to the visible world, nor does it clarify to what extent Plato thought of the demiurge as a mythical *explanans*. But it does show that in vocabulary and imagery Plato's conception of the production of living entities has significant points of contact with that of Aristotle, even in an act of creation which Aristotle thought could never have taken place.

For both Plato and Aristotle a new entity comes into being when a form, which was previously outside the Receptacle or matter, passes into it. In *De Caelo* (306b16–19) Aristotle says: 'The substratum must be formless and unshapen – for thus the "all-receptive", as we read in the *Timaeus*, will be best for modelling'. For Aristotle, this substratum, prime matter, has only a logical priority to the elements; it can never exist independently at any lower form of qualification than that of fire, air, water and earth. For Plato, on the other hand, the existence of the unqualified Receptacle is a temporal stage preceding the emergence of the elements.[8] Of course Plato never gives the Receptacle a label comparable to 'substratum' or 'matter',[9] but he does call it ἐκμαγεῖον ('moulding stuff') at *Timaeus* 50c, the same word as that used, at *Theaetetus* 191c, to refer to the wax which receives impressions. But before any object can be impressed upon the Receptacle, even by the demiurge, it too must take on the more qualified nature of the elements produced by Necessity. The elements of Necessity, however, are not brought into being by the imposition of form but by the mechanical processes of shaking and like attracting like. The Forms of the elements existing outside the Receptacle play a later role in the creation of this world.[10]

It is these Forms which Plato primarily thinks of at *Timaeus* 50c–d as existing outside the Receptacle. Although he says that the Receptacle is devoid of all character before the impression of these Forms he also says at 51b that the most accurate description of it at this stage would be:

> πῦρ μὲν ἑκάστοτε αὐτοῦ τὸ πεπυρωμένον μέρος φαίνεσθαι, τὸ δὲ ὑγρανθὲν ὕδωρ. γῆν δὲ καὶ ἀέρα καθ' ὅσον ἂν μιμήματα τούτων δέχεται.
>
> That part of it which has been made fiery appears at any time as fire; the part which is liquefied as water; as earth or air such parts as receive likenesses of these.

This means that the Receptacle has received the μιμήσεις ('likenesses') of the elements by Necessity, but the ordering of the world into particulars needs the more rational principle of the εἴδη, the 'forms', of the elements. Creation proper will begin by imprinting each of the elements produced by Necessity with the corresponding form or εἶδος. Only then can the production of compounds begin.

In the main sexual reproduction simile, Plato likens the Receptacle to the mother, the eternal reality that is being copied he likens to the father, and the resulting particular thing to the child. Plato adds that the Receptacle will itself be completely formless, for, if it had any form at all, it would hinder the reproduction of any other form. Cornford notes that here Plato 'implies a current view (i.e. of the fourth century BC) of the part played by the mother in generation', and adds: 'If it (the receptacle) had any qualities of its own, it would intrude its own features or visible appearance, as the mother's features might be expected to reappear in the child, if she contributes any part of her substance'.[11] But this, of course, is precisely the stumbling block: children do often resemble their mothers. Moreover, while a child may be said to be made *in* its mother, it cannot be described as being made *out of* her. She herself is not 'moulding stuff'.

One way to resolve the dilemma within the *Timaeus* is to take the term μητρί ('mother') at 50d3 as an example of synecdoche – the use of part for the whole – in which the reference is only to the womb, rather than to the mother herself. This would reflect Plato's description of the womb later in the *Timaeus* (from 91c) as an independent animal within women which is responsible for procreation. The use of the synecdoche of womb for mother to characterize the Receptacle at *Timaeus* 50d does not mean that Plato thought furnishing a womb was a mother's only role in reproduction. That he takes it for granted that she also contributes something to the child over and above a place for its gestation is shown at 91d where the desire and love of *both* parents, *not* just the father, are seen as 'having sown'

(κατασπειράντες) a child in the womb as in a field. In fact, the passage goes on to describe the entire pregnancy as if it were a joint project of both parents.[12]

The seed of both mother and father originates outside the womb, and their mingling within the womb would explain the resemblance of children to both parents. Furthermore, since no particular in this world is a perfect or even an imperfect copy of any one Form and the Receptacle itself is completely formless, we must assume that each particular bears the imprint of more than one Form, just as each child bears *some* resemblance to more than one parent.

It might be argued that at least the elements take after only one Form. But *Timaeus* 56c–61c discusses how the primary bodies which make up fire, air, water and earth in this world can be recombined so that one element can change into another, and the passage goes on to describe the different kinds of fire, air, water and earth that can appear in this world. So even at the elemental level we do not see the simple pattern of one Form impressed upon matter to produce one offspring.

The 'parental' Forms exist outside the Receptacle and the Receptacle, like the womb, provides both place and, as Aristotle thought, material for the gestation of the offspring. Plato applies the term μητρί, 'mother', to the Receptacle in reference to one of the roles of the female in reproduction. The provision of form is the father's only role, hence the deployment of the term πατρί, 'father', but Plato did not thereby imply that any one particular in this world partakes of only one form.

I have argued elsewhere[13] that the view that only the father contributed 'seed' to the offspring was not in fact common in the Graeco-Roman world, for the very reason that it made resemblance to the mother difficult to account for. Most theories of reproduction required *material* contribution in the form of semen from *both* parents, with a further contribution of menses from the female parent to nourish the foetus growing in the womb. The many problems arising from the assumption that resemblance to parents was caused solely by matter were compiled into a withering list by Aristotle,[14] who concluded (correctly according to current theories of reproduction) that what was needed to be passed on was not so much material from specific body parts but information on how to build a particular kind of body. The information has to be passed into some material, and empirically the best candidate for this is the menstrual fluid, for before its appearance at puberty a woman is not fertile, and it ceases to appear during pregnancy. But if a mother were able to pass the relevant information into this material herself, carried in the womb within her body, there would be no need of a father. Aristotle therefore argues that

a female can concoct her menstrual fluid only to the point of carrying nutritive soul – the stage at which it reaches the potential of taking on the actual human soul which is carried by the father's semen.[15]

The semen of the male, Aristotle argues, is concocted to the point at which it is able to carry the 'movements' of the father's form into the female matter, thereby 'setting' it first into the general form of an animal (which will be aborted if not further differentiated), then into the species form. If the semen carries enough heat the species form will take on the 'movements' of the male sex, which will entail that the body develop in such a way as itself to be able to concoct semen. But if the semen is not quite so hot, or there is a large amount of matter to be informed, the species form will assume the *archē* of the female sex, entailing that the body develop in such a way as to be able to concoct the seminal residue only to the point of potentiality for the species form, but without the ability to pass the species form, which it itself carries, into its seminal residue. The reason failure to produce a male resulted in a female, says Aristotle, is that things change not randomly but into their opposites; the 'movements' therefore of the male change into 'movements' of their opposite, those of the female.

In his reproductive theories Aristotle also talks of a fourth set of movements, one step beyond the sequence of animal, human and sex.[16] These individuate particular animals with respect to eye colour, nose shape, body type and the like. In the *Metaphysics* such characteristics are the result of the matter in which a species form is instantiated, but in the reproductive theories they are said to pass into matter as part of the animal's form. As with the determination of gender, Aristotle maintains that if the father's individual movements are not strong enough they will revert to their opposite, the individual movements of the mother.

To many scholars this has seemed an *ad hoc*, not to say mysterious, attempt belatedly to account for the resemblance of children to their mothers, which Aristotle had failed to make proper accommodation for because of his supposed sexist tendencies.[17] There have, though, been more sympathetic attempts to identify some cogency in his remarks on how children can come to resemble their mothers if the mother's only contribution to the foetus is her menstrual fluid.

Balme (1985) argues that Aristotle solved the difficulty by locating the mother's individual movements in her seminal residue, the menses, even though Aristotle is adamant that the menses cannot contain the species form. That is why, according to Balme, Aristotle sometimes refers to menses as 'seed'. His primary evidence that Aristotle believed female seed could carry a mother's individuating characteristics comes from *Historia*

Animalium book 10, which has generally been viewed as a spurious work since 1560.[18] But even if we were to grant Balme that *HA* 10 is a genuine work of Aristotle, written considerably earlier than the rest of his biology, it would not help to explain Aristotle's theory of reproduction in the rest of his works because, according to *HA* 10, the female seed, which carries the mother's form, is produced *in addition to* menstrual fluid, whereas in the rest of his biology Aristotle is adamant that no animal can produce two seminal residues. Aristotle may have had a different point of view on this at some point in his life, but it is so opposed to what he says elsewhere that we cannot simply collapse female seed and menses into one entity.

Cooper (1988, 30) argues that 'the father's sperm...has to have, in some way or other, those movements <of the mother> potentially in it'. By this he means that the mother's individual movements are present as movements in matter, not as formal movements. The father's semen 'selectively elevates' them from being movements *of* matter to movements *in* matter. Thus, the instantiation of the father's individual form can be affected by the nature of the female matter in the way that the quality of the stone used can affect the statue a sculptor is trying to produce, the more so if the sculptor is less proficient. But menses are not pre-formed to any extent in the way in which a block of stone might be by fault lines or similar defects; they are more tractable and homogeneous, comparable rather to molten bronze. More importantly, when talking of the mother's movements, Aristotle never locates them *in* her menses. If the mother were to have potential individual movements in her menstrual fluid, she would also have to have potential animal, human and female movements; it is impossible to have potential 'snub' without potential 'nose'. This would suggest a competing source not only for individual movements but also for the *archē* of the female sex, a source which would be likely to lead to a much higher rate of hermaphroditic births than actually occurs. One of the advantages of Aristotle's theory is that it explains sex as a modification of species form (an individual of a sexually dimorphic species is nearly always one *or* the other), rather than as part of hereditary resemblance, which would make it much harder to explain why a child cannot regularly pick up sexual traits from both male and female parents. Plato's account of the derivation of the female brings with it many problems of its own, but in so far as he does not posit *two* separate living worlds to derive sexual dimorphism among natural kinds,[19] he too views the female as a modification of the human form.

In my earlier treatment of this issue I argued that Aristotle could have resolved the problem (but chose not to) by allowing the father

to contribute some matter to the generation of offspring, in which case resemblance to parents' individual characteristics could have been accounted for symmetrically, and consistently with what Aristotle says elsewhere about individuating characteristics below the species form, by the *matter* received from mother and father.[20] But of course this would not resolve the problem, because if the father could produce both form and matter there would be a risk, as in the case of the mother, of the father producing homunculi unaided. If matter were the sole male contribution and form the sole female, we are left again with the problem of asymmetry in accounting for resemblance.

I suggest therefore that the problem can be resolved if we keep in mind Aristotle's basic approval of the functioning of the Receptacle of the *Timaeus* and the role Plato assigned to it in his simile of sexual reproduction. In this simile the Receptacle represents the womb and, in Aristotle's mind at least, the matter of sexual reproduction, namely the female menses. Since Necessity pre-formed the elements before the demiurge introduced a rationalization of the stuff into the things of this world, this matter is obviously not prime matter; it is informed to the point of being ready to take on the animal form, but it cannot have any individuating characteristics of its own or else the father's form could *never* appear to be instantiated almost perfectly. The mother's form, like the father's, therefore has to be outside the womb, in the same way as the truly existing things are outside the Receptacle. The mother's form is in her body, but it cannot shape the menses until they have been further concocted by the male heat contained in the semen. According to *De Generatione Animalium* 731a19–21 it takes several days for semen to set the menses into a fetation. That the species (and therefore the sex) movements are passed over prior to the individual movements is shown a little later at *GA* 757b1–5 where Aristotle says that the semen of one cock can impregnate and set the eggs of a hen, but a subsequent treading of another cock can cause that clutch of eggs to resemble the second cock.

Once the menses have been informed to the extent of taking on the species and sex movements, then the individual movements of the mother and father can each try to set their impress on the offspring. That Aristotle thought it possible for the form in a body to work directly on the female seminal residue without the intermediary tool of semen is shown in his discussion of the males of spiders and other insects which, he says, do not have sufficient vital heat to concoct semen, but do have an *archē* hot enough to pass on their species form to a new individual if the seminal residue is brought to them. In their case the female has to insert part of

her body directly into the male body, and they have to stay united for a considerable time. The movements in the male body then work the material as a potter works clay rather than as a carpenter works wood, i.e. with hands rather than a tool.[21] This is the way that *every* mother passes on her individual movements to her children.

To elaborate on one of Aristotle's common analogies, a mother is like a builder who has plans for framing and dry wall, but who cannot proceed until some builder, a little more skilful, has poured the slab, which determines the overall shape and such important elements as the plumbing. The analogy does not quite work because the house will have no 'hidden' movements whereas the individual movements of the parent that are not openly expressed in the offspring will still be contained within it, possibly to be passed on to future generations. In this way the offspring, for Aristotle, could never be a perfect reproduction of its parent, however much it might seem to be so at first glance, because it would always contain the parent's 'opposite' in a way similar to that in which, for Plato, particulars which seem to instantiate a form perfectly can also be shown to partake of its opposite.

In the *Timaeus* the identification of the Receptacle with the mother did not preclude Plato from attributing to the mother, as to the father, the role of Form *vis-à-vis* her offspring – in so far as her form stands outside of her womb. Similarly Aristotle's insistence that a female's contribution to conception was purely material did not prevent him from giving her individual form a role as long as it remained outside of the seminal residue in her womb.

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Notes

1 'Aristotle refers to the *Timaeus* more often than any other dialogue', Fine 1993, 38.

2 Cherniss 1962, 86–7; Fine 1993, 196; Claghorn 1954, 5–19. See Charlton 1970, 129–45, for the view that Aristotle himself did not have a concept of prime matter.

3 Cf. *De Caelo* 279b32–80a11.

4 *Tim.* 50d. [The translations given from the *Timaeus* are from Bury.]

5 I translate φήσας as concessive (i.e. Plato *could* have made better use of it) under the influence of the following καίτοι, which in introducing an objection implies that the previous statement was generally favourable.

6 Cornford 1937, 28.

7 Cf. *Timaeus* 55c–d where Plato reconsiders the question in terms of whether there might be five worlds.

8 Cf. Devereux 1985, 226.

9 Plato, in the *Timaeus*, always talks of the particulars as coming to be *in* the receptacle, not as being made *out of* it. For the purposes of my argument it is irrelevant whether *Plato* actually thought of the receptacle as some form of matter, although a good argument could be advanced for making this assumption. His avoidance of an explicit description of the Receptacle as some sort of stuff no doubt reflects the fact that for him it served (at least primarily, and maybe solely) as place. However Aristotle criticizes him for identifying place and matter at *Phys.* 209b12–14, 35–21a2. For Aristotle, then, Plato's description of the particulars as coming to be *in* the Receptacle is tantamount to his saying that they were made *out of* it.

10 I am indebted to an unpublished paper by Sergio Zedda, 'Sexual dialects in Plato's *Timaeus*', for alerting me to this point.

11 Cornford 1937, 187.

12 Perhaps the perception that, in a sense, the womb was a shared organ of reproduction gave rise to the cultural view (widespread in many societies) that the womb has an existence independent of the woman whose body it inhabits. Adair 1996 argues that the theory of the wandering womb was simply too preposterous for Plato to have accepted. He suggests an alternative reading of the passage in which ζῷον ἐπιθυμητικὸν ἐνόν should not be taken in apposition to ὑστέραι because it is singular, and that instead it should be read as denoting a desiring spirit which resides within the womb. This interpretation involves translating ἐν ταῖς γυναιξίν in the preceding clause as if it were in the predicate position rather than its apparent attributive position after αἱ, and is thus not persuasive.

13 Dean-Jones 1994, 148–53.

14 Ibid. pp. 164–5.

15 Ibid. p. 185, n. 128.

16 I am not here going to attempt to explain how these movements can be reconciled with the apparent contradictory statements Aristotle makes in his *Metaphysics* about the impossibility of individuation in form below that of species, see Dean-Jones ibid. p. 181, n. 111.

17 e.g. Horowitz 1976, Saïd 1981.

18 Cf. the editor of the Felicianus translation.

19 See above, pp. 103–4.

20 Dean-Jones op. cit. p. 196.

21 Cf. *GA* 730b25–32.

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7

PROCLUS ON DEMIURGY AND PROCESSION: A NEOPLATONIC READING OF THE *TIMAEUS*

Jan Opsomer

Of the extant ancient commentaries on the *Timaeus*, that by Proclus is certainly the richest and most interesting. Moreover, it is one of the most important works of late ancient Neoplatonism. In this work, Proclus deals extensively with the enigmatic figure of the 'demiurge': who – or what – is he? What is the nature of his activity? How is it related to that of the young gods, the lesser demiurges, whose role is explained from *Timaeus* 42a onwards? These and similar questions – essential also for *our* understanding of the dialogue – are discussed by Proclus within the framework of the metaphysical system of the Neoplatonists. However, this system, so these philosophers claimed, not only elucidates the one and only truth, but it is also the only correct interpretation of Plato. One of the purposes of my contribution is to show some of the hermeneutical assumptions underlying this attempt to extract a consistent system from the texts of Plato. The focus of my text will be how demiurgy, that is, the productive activity proper to a demiurge, is reconcilable with the Neoplatonic notion of procession, according to which all reality 'proceeds' or 'emanates' from a supreme principle, the One.

Neoplatonic reality is multi-layered and hierarchically structured,[1] whereby all that exists proceeds from a single, ineffable cause, the One or the Good, and reverts to it.[2] The ontological levels that are more remote from the One are characterized by an increasing complexity and multiplicity. The procession is continuous, as it is accomplished through a likeness of the posterior to the prior,[3] yet at the highest levels reality is unmoved, whereas the physical world is in perpetual motion.

How the causal transition between these two realms is to be conceived is one of the most problematic issues for the Neoplatonists, given their concept of causation, according to which the cause is always like the effect, and some property must pass over from the one to the other.[4] Where does motion arise for the first time, and can it ever be said to be

caused as a property by an immobile reality superior to it? Since nothing is supposed to happen without a cause, the Neoplatonist ought to be able to give a causal and metaphysical explanation for motion. What is needed therefore is an unmoved mover that acts as an efficient cause by producing a being in motion.

In the *Elements of Theology*, Proclus explains that the first entity set in motion is the self-moved or intrinsically moved, which is the link between the unmoved and the things which are moved extrinsically.[5] The self-movers are of course souls and they are in their turn causally dependent upon an unmoved principle, the Intellect.[6] The souls may be self-moved, but their moving power still needs to be causally accounted for, and therefore motion must pre-exist at the level of Intellect, albeit in an immobile way: Intellect is something that is a mover of other things (κινοῦν μόνον), and not itself in motion (οὐ κινούμενον). Demiurgy will be concerned with the passage from 'unmoving motion' to 'moving motion'.

Although immobility is what distinguishes the higher realm[7] from the sensible world, a certain type of motion is essential to it, but a motion that is atemporal and non-spatial. In his profound study ΚΙΝΗΣΙΣ ΑΚΙΝΗΤΟΣ (1973),[8] S.E. Gersh has explained the relationship between this 'spiritual motion' and multiplicity. Proclus expressly links motion with the differentiation of the manifold internal subdivisions in the higher realms, that is, with the presence of difference combined simultaneously with identity, which is the condition for the 'unfolding' of multiplicity from unity.[9] Motion or activity[10] is essential to the higher hypostases: 'Any metaphysical principle exists only in terms of its motion in relation to its prior, and this motion is not the cause of its existence, but that existence itself, and that existence itself is the activity of the principle' (1973, 100).

Motion in the sensible world is then already prefigured in the intelligible world (in the broad sense), more precisely in its multiplicity and 'immobile motion'. There is to be found the ontological cause of motion as we know it. But, of course, one would assume spiritual motion to be thoroughly different from its physical counterpart in that it is beyond time.[11] Therefore, to explain how motion is generated by immobile principles amounts to explaining the (causal) transition from eternity to time.[12] Actually, the latter problem is more fundamental, for time transcends motion – motion is 'measured' by time – and their relation reflects and is analogous to the relation between eternity itself and the eternal life of intelligible and intellective beings.[13]

Procession and timeless production have long since drawn the attention of numerous scholars, but what is lacking is a thorough study of demiurgy

as such and of the mediation between timeless causes on the one hand, and effects that belong to a world of perpetual change on the other. In this contribution, I set out in a rudimentary fashion some elements of this problem.

I. The causal activity of the demiurge

There is activity even in an eminent and truly paradigmatic way at the higher ontological levels. Moreover there is production, for the higher levels give existence to the lower in a single, unbroken procession. Not all production, however, is demiurgic. Proclus restricts demiurgy to the production of 'what is always becoming'; the cause mentioned by Plato in the *Timaeus* is the demiurgic cause, and not just anything productive of something else. Indeed the Good is the cause of all the intelligibles,[14] but not their demiurgic cause. For, Proclus continues, in the *Philebus* the term 'demiurgy' is expressly linked with becoming. Therefore, although there are many realities producing other realities in the realms that are ontologically prior to the universe, demiurgic causes are causes only of things that are becoming.[15] So at some point, or rather at some level, procession turns into – or manifests itself in the form of – demiurgy. Where exactly in the ontological scale this happens needs to be determined with more precision.

Plato explains the nature of the causal activity of the demiurge at the beginning of the physical account in the *Timaeus*, immediately after the lines in which he introduces the basic distinction between 'that which always is and has no becoming, and that which is always becoming and never is' (27d5–28d4). Proclus comments that Plato by these words indicates the most basic ontological distinction between the world of real being (i.e., according to the plan given below in the Appendix, levels [2]–[4], and by extension levels [5]–[6])[16] and the world of becoming (from level [7] downwards),[17] namely the distinction between time and eternity.[18] Following from this, Plato states that 'everything which becomes must of necessity become by the agency of some cause (ὑπ' αἰτίου τινός), for without a cause nothing can come to be.'[19] Proclus infers from the use of the preposition ὑπό that Plato is speaking about efficient causality, while τινός ('some') is taken to indicate that the demiurgic cause is just one of the many efficient causes there are.[20] There are of course cases of causation where both cause and effect belong to the physical world, but there is also efficient causation that remains entirely in the intelligible realm. One could add that demiurgy[21] is actually a very special case, for only then do cause and effect belong to different realms (if by realms we mean here the basic distinction between being and becoming). Proclus also

insists on the claim that demiurgic activity constitutes a unity: there is one single cause and one single providence for everything,[22] for otherwise the world would not be a whole, but a dispersed and fragmented collection of entities subject to pure hazard. All multiplicity in the world is ultimately reducible to one demiurgic cause, so that there is truly a 'golden chain' co-ordinating the universe.[23] The single demiurgic cause is the divine craftsman of the *Timaeus*. He creates the world as a whole and is ultimately responsible for every single thing that is created. Yet, seen from another perspective, he also supervises a multiplicity of demiurgic activities. There is a sense in which he is not the only demiurge, for the *Timaeus* mentions the young gods who also have their demiurgic activity, and even the world soul can be considered to have demiurgic power, in that it orders and structures the universe. This latter fact had already been noticed by Numenius and Plotinus.[24] Proclus actually excuses Plotinus for ascribing demiurgic activities to an immanent principle, interpreting it as the immanent intellect of the world,[25] since by distinguishing two levels of demiurgy Plotinus also shows that he understands that the true demiurge really belongs to the hypostasis of Intellect (which is his name for the whole realm between the One and the world, whereas Proclus limits Intellect to the lowest level of that realm).[26] Since, according to Proclus, all the lower forms of demiurgy are causally dependent upon the universal demiurge, they can ultimately also be reduced to him, so that in some sense there is only one demiurge.

II. The ranking of the demiurge

Which rank should we assign to the universal demiurge? At this point in the history of Platonism, it had long been established that the demiurge could never be the supreme God, and that his position in a complex and hierarchical pantheon should be relatively low.[27] The latter is not just an historical coincidence: I see also an exegetical and a systemic reason. The exegetical reason is that Plato calls the demiurge an intellect and that Intellect occupies, in Neoplatonic theory, the third position in the main triad Being-Life-Intellect (levels [2]–[3]–[4]). Intellect (level [4]) is that which looks at, and is therefore posterior to, the intelligible paradigm (Being, level [2]).[28] The systemic reason is that the demiurge is the principle that transmits the powers of the higher realm to the physical world and therefore needs to be quite close to it. Nevertheless, as Intellect should also remain pure and transcendent, its causal activity needs to be mediated. The hypercosmic and hypercosmic-encosmic realms ensure that Intellect remains uncontaminated by the encosmic realities.

Proclus claims[29] that the perceptive reader of the *Timaeus* can determine

the rank of the demiurge with great precision: Plato explicitly calls the craftsman an intellect,[30] he says that the demiurge looks at the intelligible model,[31] and, for Proclus, it is obvious that something that contemplates the intelligible is itself intellective, i.e., an intellect. In addition, some of the demiurge's other activities are typically that of an intellect, for he discovers and reasons (although in the case of the universal demiurge these activities will not be discursive, as will soon become clear);[32] and Plato also teaches us that the demiurge is the best of causes (*Tim.* 29a6), wishing us to understand that he is superior to other forms of demiurgic causes. So far, then, we have learned that the demiurge of the *Timaeus* is the highest of all demiurges and that he is intellective; in other words, he belongs to the realm of Intellect [4].[33] But which position does he occupy inside this realm? In order to answer this question, we have to enter further into the technicalities of the Proclean system. Intellect has the structure of a hebdomad,[34] consisting of two triads and a 'seventh divinity'. The seventh divinity [4.3] is also called 'the membrane', and has the very specific function of separating this class of divinities from the other realms and of establishing the necessary internal separations within the realm it belongs to.[35] The second triad [4.2] can be discounted as well, as it merely duplicates the first on a lower level, thus preventing it from 'falling towards matter'. Hence we have to look at the first triad [4.1]. The first member of a triad is typically concerned with its inner activity, but a demiurge clearly needs to have an outward activity as well. The second position in any triad is that of life. That the demiurge is not primarily the cause of life is shown by Timaeus' account, for the demiurge needs to go to the mixing bowl for the creation of the soul (41d4–5).[36] But when he imparts intellect to the universe (30b4), he can do so entirely by himself, which indicates that he is essentially the cause of intellect. Therefore it is clear that he occupies the third position in the triad, as that is the typically intellective position.[37] Thus the demiurge occupies the intellective position inside the intellective realm: he is intellective intellect [4.1.3].

The activity of the demiurge, as an intellect, is beyond time and will be – in this sense – motionless. He will also have no activity outside of his very being: his being *is* his activity, and it is eternal. In other words, when he produces, he will do so 'by his very being' (αὐτῷ τῷ εἶναι), as it is expressed conventionally, and not as a result of deliberation.[38] What to make then of the *Timaeus*, where the demiurge is said to 'reason' and 'find' (λογισάμενος οὖν ηὕρισκεν, 30b1)? In the *Platonic Theology*, Proclus explains that the reasoning of the demiurge is to be understood as merely analogous to actual reasoning – the demiurge does not reason 'by transition' (οὐ κατὰ μετάβασιν), for his thinking is eternal. Likewise,

his finding is not the finding of something that was absent, for everything is always and eternally present to him. There is no question, then, of 'searching', 'being in an *aporia*' or 'erring'. What Plato calls 'reasoning' is just intellect's turning upon itself, and 'finding' is the fulfilment that stems from the intelligibles.[39] Now the (alleged) fact that the craftsman of the universe eternally generates all things also means that there has not been a beginning to his activity and that there will be no end to it, and hence no end either to the universe.[40]

Theologically, the demiurge is identified with Zeus,[41] which according to Dillon 2000 (346–7) may not have been as uncontroversial as one might think. Proclus substantiates his claim by quotations from various dialogues.[42] Let us look at some examples. In the *Philebus* Plato affirms that a royal soul and a royal intellect pre-exist in Zeus in the mode of the cause.[43] It is the same soul and intellect of the world, claims Proclus, that are generated by the demiurge in the *Timaeus*: he places intellect inside the world soul and the soul inside body at *Tim.* 30b4–5, and he declares the laws of destiny to the divine souls of stars at 41e2–3. Hence, the demiurge of the *Timaeus* must be identical with the Zeus of the *Philebus*. In the *Statesman* this world is said to be under the reign of Zeus (272b2); insofar as it is able, it remembers the instruction of its demiurge and father (273b2–3). If its life stands in the sign of Zeus, Zeus must be its maker and father, and must be identical with the demiurge of the *Timaeus*.[44] It is no coincidence, according to Proclus, that he receives exactly the same title in both dialogues: 'demiurge and father', in this order (*Pol.* 273b2; *Tim.* 41a7), or, with a slight variation, 'maker and father' (28c3–4: τὸν μὲν οὖν ποιητὴν καὶ πατέρα τοῦδε τοῦ παντός). This title is to be distinguished scrupulously from the titles 'father', 'maker', and 'father and maker'. The title 'father' belongs to the summit of the intelligibles [2.1], whereas the mere 'makers' are the lesser, encosmic demiurges [7].[45] In between these two extremes we find the two combined titles, of which 'father and maker' is the highest. The 'father and maker' is the universal paradigm, which is equated with the third intelligible triad (the intelligible Living Creature, also known as Phanes) [2.3]. In the 'father and maker' the fatherly element predominates, in the 'maker and father' the demiurgic element is more prominent.[46] Using a beautiful but somewhat mysterious expression, Proclus says that whereas a father produces by his very being, 'as his activity belongs to his very existence', a maker produces by his activity, 'since his existence consists in his activity'. Proclus must mean that for a father existence is logically prior, in the sense that activity is just the invariable expression of existence, while for a maker it is the other way round.[47] The fatherly cause generates eternal beings, while the merely

demiurgic cause (insofar as it lacks the fatherly aspect, which is not the case for the universal demiurge), creates mortal beings.[48] At this point comes the distinction between the two demiurgies in the *Timaeus*, that of the universal demiurge and that of the young gods. However, before we reach the level of the latter, we shall have to deal with a fair number of other demiurges. Let us therefore now consider briefly the hierarchy of demiurgic causes.

III. The four forms of demiurgic cause

Proclus usually distinguishes four forms of demiurgy.[49] Next to the 'one demiurge', who creates universal beings in a universal way (τῶν ὅλων ὁλικῶς δημιουργικὸν αἴτιον), there is a demiurgic triad which creates partial beings in a universal way (τῶν μερῶν ὁλικῶς), a monad that creates universal beings in a partial way (τῶν ὅλων μερικῶς) and a triad that creates partial beings in a partial way (τῶν μερῶν μερικῶς).[50] The more basic distinction is that between two modes of creation, the universal and the partial (designated by the adverbs ending in -ως), rather than the distinction between what is being created (given in the genitives of universal contrasted with partial beings). This should be no cause for surprise as the *modus operandi* of creation is more closely associated with the nature and activity of the demiurgic causes themselves. So when Proclus just speaks about 'universal demiurgy', he refers to the first two levels of the fourfold division, whereas by 'partial demiurgy' he means the last two. The universal mode corresponds to the first demiurgical operation of the *Timaeus* (that of *the* demiurge), the partial to the second stage in the demiurgy of the *Timaeus*, that of the young gods. The first demiurgy is completely transcendent, the second encosmic.

The internal organizations of the universal and of the partial demiurgy are identical: both consist of a monad followed by a triad. One wonders how Proclus could justify these fanciful arrangements, for the *Timaeus* warrants only a distinction between *the* demiurge and the so-called young gods, and of a demiurgic triad, let alone of two triads, there is not a trace. Yet Proclus was too much of a faithful Platonist and exegetical wizard to introduce theological distinctions without adducing textual evidence for them. So let us take a closer look to see if there is more to be drawn from the texts. Unfortunately the part of the *Platonic Theology* where Proclus would have discussed the encosmic demiurgy is lost, if it was ever written at all. And the *Timaeus Commentary* as we have it does not contain a systematic account of the entire demiurgy, but just sporadic references to different lower forms of creative activity. Reconstruction is what is called for. In my forthcoming article *La démiurgie des jeunes dieux selon*

Proclus, I attempt such a reconstruction of the lower forms of demiurgic efficiency. For the supporting evidence and an elaborate argumentation I have to refer the reader to this article. There is also an account there of the hierarchy of creatures and of paradigmatic causes.

We are relatively well informed about the second level of the fourfold division, that of the triad ordering parts in a universal way, since this is extensively discussed in the extant sixth book of the *Platonic Theology* (chapters 6–10). The main exegetical reason for acknowledging a triad of demiurgic gods is the *Gorgias* myth, where it is said that Zeus, Poseidon, and Pluto divided the kingdom of their father among themselves (523a3–5).[51] The activities of these gods are clearly providential, and therefore demiurgic. However, Proclus discerns a double status assigned to Zeus in this text: Zeus is one of the three kings, but he is also the sovereign ruler of this world (523b5). The latter is the universal demiurge who has taken over the reign from his father (just like the Zeus of the *Statesman* myth, who is also equated with the universal demiurge). The second Zeus, i.e., the first member of the triad, must be a lower demiurge, belonging nevertheless to the chain or series which is rooted in the first Zeus. This triad of which the second Zeus is the first member is the hypercosmic demiurgic triad, responsible for the production of parts in a universal way (τῶν μερῶν ὁλικῶς [5.1]).[52]

There may also have been historical reasons for acknowledging a triad of creators. Several earlier Platonists, such as Amelius and Theodorus, had posited three demiurges.[53] Proclus, no doubt once again following his master Syrianus, admitted that indeed there are three demiurges, but insisted that they cannot be the highest form of demiurgy, for all multiplicity must be reduced to unity, and this is also true of demiurgic causes. Otherwise, if no unity could be found among the causes, then the universe itself would be characterized by a fundamental lack of unity and coherence.[54]

The three gods of the hypercosmic demiurgic triad are responsible for existence, life, and the intellective reversion (the reversion of beings to their cause is essentially an activity of intellect, since intellect is what it is by contemplating its cause). Now all of these creative activities pre-exist causally in the universal demiurge.[55] This is the true reason why a demiurgic monad must precede the triad.[56] As the inevitable result of the declension (ὕφεσις), i.e., the gradual decline in power as one moves down the ontological scale, the demiurgic triad will not be able to maintain the same degree of unity as the universal demiurge – that is why it is 'of parts'. But, thanks to its proximity to the first efficient cause of demiurgy, it will preserve the form of production, which is universal.[57]

The triadic division manifests itself in more than one form. Proclus also holds that the three kings of the *Gorgias* divide among themselves the realms of the universe and can be considered as a celestial, an aquatic and a chthonic manifestation of Zeus.[58] How these different classifications combine is not clear, unless one assumes that the celestial is primarily the realm of existence, the aquatic that of life, and the chthonic that of intellective reversion.[59]

In analogy with universal demiurgy, the partial or encosmic demiurgy consists of a monad and a triad. But before the 'demiurgic chain' reaches the encosmic level, there is yet another demiurgic triad, namely the first triad at the hypercosmic-encosmic level [6.1], consisting of the third Zeus, the second Poseidon and Hephaistos. As the name already indicates, this level is intermediate between the hypercosmic and the encosmic. Its function is to separate and at the same time connect both *diakosmoi*. The hypercosmic-encosmic demiurgic gods 'are unified from above by the ruling leaders [i.e. the hypercosmic Gods], and from below they are drawn into multiplicity by the young gods, as Timaeus says'.[60] In other words, the hypercosmic-encosmic triad can be seen as the dividing line separating the first two from the last two levels of Proclus' fourfold division. As an intermediate realm it participates both in the hypercosmic and the encosmic *diakosmoi*. It indeed corresponds to the dialectical attribute 'in contact and separated' (as in *Parmenides* 148d5–149d7), which means that it is both in contact and not in contact with the world. The intermediate character of this realm explains why its demiurgic triad plays no role in Proclus' fourfold division of demiurgy.[61]

The encosmic pantheon is organized after the image of that of the immobile gods. Although the structures become increasingly complex as one moves down the ontological scale, the image-character of the cosmos warrants the assumption that the relations between the encosmic gods will be analogous to those among the hypercosmic and intelligible gods.[62] To grasp the full complexity of the encosmic demiurgy may be beyond our ability,[63] but at least we know that in essence it will consist of a monad followed by a triad. Besides the parallelism with universal demiurgy, there is a specific reason why the encosmic demiurgy needs to be headed by a monad, namely the coherence of the universe; and there also needs to be at the inner-worldly level one single cause that brings together all other causal efficiency, for otherwise the world could never form a unity.[64]

The leader of the encosmic demiurgic gods is called (the monad of) Dionysos. He is the offspring of the hypercosmic Zeus$_2$ and Korē, and probably has an ambivalent status – that of an essentially hypercosmic god in an encosmic environment.[65] In this aspect he would be like Helios,

a god with whom he is associated[66] but not equated. Dionysos' demiurgic role can only be understood from the Orphic tradition. According to the myth the young Dionysos was installed by his father on the latter's throne as king of the gods, but the young god left the throne in order to join the feasting Bacchae, who are in fact jealous Titans in disguise. The latter tear Dionysos to pieces, but his heart is saved by Athena, while his members are gathered by Apollo. When Zeus takes revenge and strikes the Titans with his lightning-bolt, the human race is born from their ashes, whereas Dionysos is reborn as the child of Semele. The Neoplatonists interpreted this story in the context of lower demiurgy. Dionysos is both undivided, insofar as he is sitting on his father's throne, and divided, as being torn to pieces by the Titans. This double nature, at the same time indivisible and divisible, symbolizes the nature of the universe, 'which has rather the character of an aggregate and is held together by a totality whose parts are distinct.'[67] Dionysos' heart is the 'intellect of the world', whereas his body is of a psychic nature: since, according to Proclus, it is divided into seven parts, it symbolizes the world soul.[68] As a reborn god, Dionysos stands for the perpetual regeneration of the universe, and he is more particularly responsible for the regeneration of the human race. The birth of man out of the remains of the Titans stands for the demiurgy of man. Indeed, our life is characterized 'by the utmost differentiation and the Titans are the lowest of creators and in immediate contact with their creation'.[69] Proclus considers Dionysos as the leader of the encosmic demiurgy and hence as the leader of the young gods of the *Timaeus*.[70] The triad of the partial demiurgy will therefore consist of Titans. I have not been able to identify this triad with any more precision, but from the analogy with universal demiurgy[71] one may assume that they are Titanic manifestations of a celestial, an aquatic and a chthonic aspect of Dionysos.[72]

Proclus' fourfold division of the demiurgic causes can then be summarized as follows: the efficient cause producing universal beings in a universal manner (τῶν ὅλων ὁλικῶς δημιουργικὸν αἴτιον) is the demiurge of the *Timaeus*, equated with Zeus and situated at the lower limit of the first intellective triad [4.1.3]. From him depends a hypercosmic triad responsible for the production in a universal way of partial beings (τῶν μερῶν ὁλικῶς) and consisting of the three ruling gods of the *Gorgias* myth [5.1]. The demiurgy that proceeds in a partial way is entirely situated at the encosmic level [7] and consists of the Dionysiac monad (the Intellect of the world) producing universal beings (τῶν ὅλων μερικῶς), and a triad of Titans, producing partial beings (τῶν μερῶν μερικῶς).

This, however, is not yet everything: Proclus adds that in the company of the partial demiurges can be found a host of assistants.[73] These are angels,

heroes, and demons, following their respective leader gods and carrying out lower demiurgic tasks in accordance with their leaders' nature.

And not even this gives us the complete picture. Sometimes Proclus mentions a *threefold* division of demiurgy: that of Zeus, that of Dionysos, and that of Adonis.[74] It is clear that the demiurgy headed by Zeus corresponds to the first two levels of the fourfold division, and one expects the demiurgy of Dionysos to be that of the last two levels of the fourfold division. But it is far from obvious where Adonis and his followers are to be fitted in. In the *Phaedrus* (276b), the gardens of Adonis are the flowerbeds where plants bud and grow quickly, but wither fast, symbolizing the premature death of Aphrodite's lover. Therefore Adonis stands for sublunary generation and regeneration, the never-ending succession of growth and decay. As I have argued elsewhere,[75] the Neoplatonists interpreted this passage as referring to sublunary creation and linked it to a passage in the *Sophist* (265c), where the Stranger makes the claim that the so-called works of nature only come to be through the intervention of a divine craftsman (θεοῦ δημιουργοῦντος).[76] This demiurge is an 'image-maker', as Iamblichus points out, and a '"many-headed being", putting forth many essences and lives, through which he brings about the variety of generation'. This sublunary demiurge is 'bound-up with non-being', but at the same time 'fixes his gaze on true being', and is 'engaged in the creation of material things'.[77] He is a sorcerer, a producer of illusions.[78]

The threefold and fourfold divisions of the demiurgic chain never appear together in the same passage, so how do these different classifications combine? The activities of Adonis seem to be included among those ascribed to Dionysos *cum suis*.[79] One may assume that Proclus, if he had wanted to harmonize the threefold and the fourfold classification, probably included the demiurgy of Adonis in that of Dionysos, since Proclus never restricts the latter's sphere of action to a *part* (the celestial part, for instance) of the universe. On the contrary, Dionysos is called *the* god of encosmic creation. The realm of Adonis has to be situated, then, in the nether parts of the cosmos, as he is the sublunary creator. At any rate he would be lower than the so-called Titanic triad that figured in the fourfold classification.

IV. The demiurge and the young gods

Despite the true proliferation of demiurges, the main distinction remains that between the universal demiurge and the young gods. In the *Timaeus* this transition is famously marked by the demiurge's address to the young gods (41a3–d3), gods generated by himself and responsible in their turn for the creation of the mortal species. Theologically, they can be equated

with Dionysos and the gods led by him (not just the mysterious Titanic triad but all the lower demiurgic forces). The universal demiurge produces while remaining himself motionless – he 'remained in his own accustomed nature' as Plato himself writes (*Tim.* 42e5–6). Whereas the demiurge creates 'by his very being', the young gods create 'by their activity', which means that they create in time (for they are encosmic) and that their activities are not motionless.[80] And this had to be so, since on the one hand their products need to be subject to change and even death, and, on the other, the laws of causality entail that immobile causes can only produce immobile effects and that, as Proclus says, 'every producing cause brings into existence things like to itself before the unlike'[81] (*Elements of Theology*, proposition 28). But then the unavoidable question is how it is possible for an unmoving demiurge to produce beings who themselves produce not in a motionless way. The Neoplatonists thought they could solve this problem and soften the transition from motionless to moving production by inserting countless intermediaries, the result of which we have just seen. The intermediaries create the impression, perhaps the illusion, of a continuous transition, and at the same time they are meant to keep the higher levels free from contamination by the lower. But is this solution philosophically satisfactory? One answer is plainly inadequate: the idea that the demiurge's activity is not just immobile but an 'immobile motion', although it was probably part of the solution envisaged by Proclus, does not solve our problem. For one ought to explain the origin of *physical* motion. To say that 'spiritual motion' prefigures physical motion is inadequate, for spiritual motion seems to be very unlike physical motion, and one would have to show that 'motion' is not just used homonymously in the two cases.

Proclus tries to emphasize in every possible way the continuity of the procession. He puts it as a general principle that the lowest level of a certain order coincides with the highest of the next order. He explicitly states this claim for the products of the two basic forms of demiurgy: the summit of the lower demiurgy coalesces with the lowest part of the first and invisible production. The heavens, for instance, form a bridge between the world of generation and the immobile hypercosmic realm. Likewise, our rational soul is a place where the two orders meet, as it has a kinship with both divine and mortal life.[82] The continuity is also manifest in the hierarchy of demiurgic causes. Proclus probably held that the encosmic demiurge Dionysos is a hypercosmic presence in the universe. At any rate, as an immanent intellect he is produced by the transcendent demiurgic intellect, and hence he is already contained in the latter ('in the mode of the cause', κατ' αἰτίαν). Conversely, the universal

demiurge is present, as something participated in (κατὰ μέθεξιν), in the encosmic demiurge.[83]

This idea can also be linked to Proclus' claim that the universal demiurge ultimately produces everything, even partial and mortal beings; but he produces them *qua* beings, and not *qua* partial or mortal. He creates mortal beings through the intermediary of (διά) the young gods: before the latter produce those beings, he has already created them just by thinking.[84] The young gods act 'independently, as it were'[85] – as being the cause of mortal beings *qua* mortal. Likewise, the universal demiurge can be said to create individuals, but not *qua* individuals. It would be foolish to suppose that he generated the intelligible form of Socrates and Plato: no, says Proclus, he only divides the mortal creatures into species (that are of course themselves eternal); nevertheless, he comprehends every individual in a universal and timeless way.[86] How exactly this happens is in a certain sense beyond *our* comprehension.

One way of understanding this is to assume that the form[87] of a *particular* individual does not pre-exist in the divine intellect, but merely the form of all individuals, whereas the world will contain individual partial beings (but this is just a guess; perhaps the demiurge even pre-contains within himself the ideas of all *possible* individuals, irrespective of their actual existence, but only insofar as they are compatible with the universal forms and all their possible combinations). At any rate, the demiurge is only the remote and ultimate cause of mortal nature; the proximate causes are the young gods, to whom he entrusts this part of the creation.[88] He delegates this power in his famous speech, to which we shall now direct our attention, under Proclus' guidance.

But first a brief remark about the name of these lesser creators. Only at 42d6 are they first called by the epithet 'young'. It is obvious, so Proclus claims, that what is meant is that they are encosmic. There are several explanations for the adjective. 'Young' may refer to the comparison with the more venerable invisible demiurgy, or to the gods' continuous rejuvenation of the universe, or to their always being in their prime. More importantly, we know from the writings of Orpheus that their leader, Dionysos, is called a young god.[89] However, Proclus also offers a more philosophical reason: the encosmic gods are young because they are perpetually being generated; their existence is coextensive with time, they are constantly 'becoming' and possess a kind of immortality that needs constant renewal.[90] They are young, then, because their essence consists in generation and a perpetual 'rising into existence'.[91] The precise meaning of this becomes clear in the address of the universal demiurge.

I now quote the beginning of this speech, in a translation which aims

to reflect the text as Proclus read and understood it:

> Gods of gods, works whose father and demiurge I am, my creations are indissoluble, if so I will. Though all that is bound may be undone, only an evil being would wish to undo that which is harmonious and happy. Wherefore, since you have come into being, you are not altogether immortal and indissoluble, but you shall certainly not be dissolved, nor be liable to the fate of death, having been allotted in my will a greater and mightier bond than those with which you were bound at the time of your birth. And now listen to my instructions. (Translation after B. Jowett)[92]

Before he starts interpreting literal phrases, Proclus first discusses the demiurge's use of direct speech, thus attributing philosophical significance to a narratological element. Since the demiurge is an intellect, his activity coincides with his thoughts: he produces by his very thinking and existing. Therefore, the words by which he orders the generated gods to finish his work symbolize the transmission of power; they are divine and demiurgic words, possessing the properties of the god who speaks them, and therefore capable of making the addressees into demiurges.[93] Their demiurgic action is necessary, for certain beings had to be created through the mediation of other gods. Indeed, if the universal demiurge had been the only creator, not a single creature would have been mortal, and as a result the universe would not have been perfect, for the lower creatures are indispensable for the completion of the world.[94]

The speech also confirms the idea that the universal demiurge is in a sense the creator of all encosmic beings, for while speaking he thinks all things, and by thinking them he creates them, including the mortal life forms. But insofar as the latter are mortal, they require another generating cause, immediately contiguous to them. In fact, the demiurge produces a hierarchy of beings, in which every higher order assists in the creation of the next lower order.[95] Thus, mortal beings are created *by* (ὑπό) the demiurge, but *with* (μετά with genitive) intermediaries and *through* them (διά with genitive). For instance, the celestial gods produce sublunary gods, and they in their turn generate mortal beings. One should envisage a chain of efficient causes, A–B–C–D–…, whereby B is directly produced by A, C by A in a transcendent way and proximately by B ('through the intermediary of', 'with the assistance of'); D is produced by A in a transcendent way and proximately by C, yet, because of the manner in which the latter has been produced, also through the – remote – intermediary of B, and hence in this way, too, indirectly by A, and so on.[96]

This is what L.P. Gerson in his book on Plotinus (1994, 29–32) calls a *per se* causal series. He argues that Plotinus takes up a subtle middle position between creationism (the doctrine according to which everything else that exists is directly produced by a creator god) and emanationism (the doctrine according to which everything else that exists flows from a supreme principle, first the highest levels of reality and from them, the lower). Plotinus offers an attractive middle position between these two, so Gerson argues, if one understands creationism as a model that is repugnant to instrumentalism (i.e., the view according to which the creator uses some of the realities created by him as instruments for the creation of others – according to Plotinus, but also Proclus, A does use B as an instrument for the production of C), and emanationism as implying a *per accidens* causal series (A causes B, and B causes C, whereby A is only a cause of B, and not of C). In Plotinus' model, for example, the One is the sole and direct cause of existence for everything, whereas Intellect is the sole cause of essence for every being. This is also basically how Proclus understands the causal series.[97]

A further remark should be made on the instrumentality of intermediate causes: as we have seen, Proclus claims that they also have a kind of autonomous activity. This must mean that they act independently insofar as they produce the property which is characteristic of their own level (καθ' ὕπαρξιν). But this brings out the problems of the model even more sharply: what causes the property c to be present in C so that the latter can produce beings that have this property through participation (κατὰ μέθεξιν)? Saying that it is already implicit in B (κατὰ αἰτίαν) does not help, for then the obvious question is: what caused its implicit presence in B?

Let us now return to Proclus' exegesis of the *Timaeus* and take a closer look at some of the expressions used by the demiurge in his speech. The vocative 'Gods of gods' highlights the productive activity of the demiurge. By speaking these words, he exercises his divinising power (ἐκθεωτική): all the recipients of these words are instantaneously made demiurgic gods.[98] These gods are next called indissoluble (ἄλυτοι), yet it is also implied that they could be dissolved (λυτοί). We should understand this correctly: a god is indissoluble by his or her own nature, and not just because the demiurge wants it that way. S/he is indissoluble because of his or her internal harmony (καλῶς ἥρμοσται) and 'good condition' (ἔχει τὸ εὖ). Hence, these gods will not be dissolved after a certain amount of time. On the other hand, they are not *completely* indissoluble, as Timaeus says (οὐδ' ἄλυτοι τὸ πάμπαν). This means that they are dissoluble in a certain sense, namely insofar as every thing that has been fastened may in principle be unloosened. At any rate, their dissolubility is not that of mortals (corruption), nor their indissolubility that of the intelligibles (i.e. that of non-composite realities).[99]

Likewise, these encosmic gods are not immortal, for 'immortal' is

properly said only of that which provides immortality to itself, and this is the case for the transcendent gods alone.[100] But of course they are not mortal either. One could say that they are both mortal and immortal, or neither mortal nor immortal. This paradox can be solved as soon as one realizes that 'mortal' and 'immortal' are not opposed without intermediary. The common interpretation of 'immortal', as a synonym for 'never dying', leaves no room for an intermediary. Yet if one considers what is primordially immortal, namely that which 'always exists' (the ἀεὶ ὄν of what is eternal),[101] one may indeed envisage an intermediary, namely the immortal as that which 'always becomes'.[102]

On Proclus' reading Plato clearly brings out this intermediate character of the young gods. 'You are neither indissoluble nor immortal' then means 'you *become* indissoluble and immortal'.[103] Plato says that they are not *completely* (πάμπαν) immortal, because he wants to indicate that there are many forms of immortality. The phrase 'you shall certainly not be dissolved, nor be liable to the fate of death' delivers them from mortality and the life that is subject to vicissitude and change and associated with non-being. The word λάχοντες, 'you have been allotted', signifies the distribution of several lots (the διακλήρωσις), and hence the fact that they distribute among themselves the unified providence of the universal demiurge. The very word thus marks the transition, in Proclus' terminology, from the universal (ὁλικῶς) to the partial (μερικῶς) demiurgy. The term 'generation' (γένεσις, 41a5) and the expression 'since you have come into being' (ἐπείπερ γεγένησθε) denote 'composition, a life bound up with time, the dependence upon an extrinsic cause, the existence of that which is coextended with the whole of time, but not always *is*'.[104]

The encosmic gods of the *Timaeus* are thus generated, not because there has been a beginning to their existence, but insofar as they are beings that perpetually become and that are constantly being regenerated. In making this claim, Proclus rejects or rather modifies the ancient axiom according to which generation entails corruption: the encosmic gods are generated, but will never be destroyed, although they are in principle destructible. So they have a nature that is situated between the immortal and the mortal, the indissoluble and dissoluble, eternity and time. The demiurge asks the young gods explicitly to operate according to their own nature (*Tim.* 41c4), i.e. according to a nature that is intermediate. This is indeed essential for what they have to do, for the continuity between the first and second demiurgy needs to be assured.[105] Moreover, the demiurge himself asserts that he himself could not have engendered the mortal species:

> If they were created by me and received life at my hands, they would become the equals of gods.[106]

In so saying, he confirms the axiom that everything produced by an unmoved cause is itself immobile.[107] Proclus explains that the products of an immobile cause operating without intermediaries are themselves immobile, whereas the products of an immobile cause, operating with the assistance of moving intermediaries, are in some respect mobile, in another immobile.[108] Indeed, no mortal being is completely mortal; even inanimate beings participate in something eternal, as their species is immortal.[109] For example, it is the demiurgy 'of parts in a universal way' that produces universal bodies, such as the four elements.[110] More generally, mortal beings receive their unity, being, and form from the first, and multiplicity, individuality, and generation from the second demiurgy.[111]

By addressing the words 'imitating the power which was shown by me in creating you' (μιμούμενοι τὴν ἐμὴν δύναμιν περὶ τὴν ὑμετέραν γένεσιν, 41c5–6)[112] to the young gods, the demiurge instructs them to imitate his demiurgic power, using it to produce other beings. Next he explains that he himself will manufacture every component that is immortal. Thus, living beings are generated as a result of the combination of mortal and immortal parts or faculties. However, in producing the rational part of the soul, the demiurge is not generating something that is absolutely immortal (not even the generated gods possess this kind of immortality; theirs is acquired from outside, as one will remember). No, he produces that which in us shares the name (ὁμώνυμον) of immortal beings and 'which is *said* to be immortal' (θεῖον λεγόμενον, 41c7). At any rate, Plato wanted to make clear that whatever *somehow* participates in immortality – and just in so far as it participates in immortality – is the product of the first demiurgy.[113]

V. Conclusion

Proclus has given an extremely sophisticated account of demiurgy: instead of just the one demiurge and the young gods of the *Timaeus*, he has multiplied the levels of demiurgy by inserting a number of intermediary stages. 'Broad is the plain of the mortal and the immortal beings, and they are bound together by many middle terms.'[114] It is clear that Proclus wanted to overcome the dichotomy and soften the transition from what is immortal and immobile to the sensible world. He creates the impression of a gradual and even continuous procession, not just by multiplying ontological levels, but also by emphasizing that the summit of a certain order coincides with the lowest manifestations of the next higher order, by claiming that effects pre-exist in their causes and by stressing the analogy and similarity between different levels.

Yet a strict application of his own axiom – proposition 76 of the

Elements of Theology – according to which 'all that arises from an unmoved cause has an invariable existence, and all that arises from a mobile cause, a variable', would lead him into difficulties. The insertion of intermediaries does not solve the problem if we take this axiom as implying that it is exactly the same property that is at each stage being transmitted from cause to effect.[115] In that case, each effect (or product) would have to be immobile (immortal, eternal, etc.) *in the same sense* as its cause. But in fact the beings produced by an immobile cause at a particular level possess an immobility which is somehow inferior to that of their cause, hence it is no longer the same property that is passed from one cause to the next. Somewhere immobility has been transformed mysteriously into motion, yet the turning point eludes us: it is always the next higher level which is immobile *when compared to* a given level, whereas the latter realm itself is immobile when compared to the next lower level. Of course, one should not read proposition 76 in isolation from the others. Proclus also maintains that a cause transcends its effect and is superior to it (propositions 7 and 75). But in what the declension consists and what properties are lost along the way, and above all, how a property can become its contrary, remain inexplicable.

APPENDIX
DEMIURGY IN THE PROCLEAN PANTHEON

1 The One			
2 The intelligible gods (*sensu stricto*), Being			
2.1 1st intelligible triad	One-Being		Father
2.2 2nd intelligible triad	Eternity		
2.3 3rd intelligible triad	Intelligible intellect	The universal **paradigm**	Father and Maker
3 The intelligible-intellective Gods, Life			
3.1 1st intelligible-intellective triad			
3.2 2nd intelligible-intellective triad			
3.3 3rd intelligible-intellective triad			
4 The intellective Gods, Intellect			
4.1 1st intellective triad, 'triad of the parents'			
4.1.1 Kronos			
4.1.2 Rhea		the mixing bowl	
4.1.3 **Zeus** (Intellective intellect)		τῶν ὅλων ὁλικῶς	**Maker and Father**
4.2 2nd intellective triad, 'immaculate triad'			
4.3 'the seventh divinity'			
5 The hypercosmic Gods (assimilative)			
5.1 1st hypercosmic triad (triad of Zeus)		τῶν μερῶν ὁλικῶς	
5.1.1 **Zeus**$_2$			
5.1.2 **Poseidon**			
5.1.3 **Pluto** (Hades)			
5.2 2nd hypercosmic triad (triad of Korē)			
5.2.1 Artemis			
5.2.2 Korē			
5.2.3 Athena			
5.3 3rd hypercosmic triad (triad of Apollo/Helios)			
5.4 4th hypercosmic triad (triad of the Korybantes)			
6 The hypercosmic-encosmic Gods ('separate Gods')			
6.1 1st hypercosmic-encosmic triad (demiurgic triad)			
6.1.1 Zeus$_3$			
6.1.2 Poseidon$_2$			
6.1.3 Hephaistos			
6.2 2nd hypercosmic-encosmic triad			
6.3 3rd hypercosmic-encosmic triad			
6.4 4th hypercosmic-encosmic triad			

7 The encosmic Gods (celestial and sublunary) [internal organization unknown]		
Celestial		
The Monad of Dionysos	τῶν ὅλων μερικῶς	Maker
The Titanic Triad (?)	τῶν μερῶν μερικῶς	
Sublunary		
Adonis	" "	
8 Universal Souls		
9 The Superior Kinds (Angels, Heroes, Daimones)	**demiurgic assistants**	

The henads do not count as a separate hypostasis. They are intermediary between the unparticipated One and participable Being, and represent the One as it manifests itself under different aspects in the lower hypostases. That is why their number equals that of the forms of beings. Limit and Unlimited can be seen as the first henads, direct manifestations of the oneness and power of the One, and proceeding through the whole of reality.

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Notes

[1] A table representing the main classes of the ontological hierarchy is given in the Appendix. In the text I have occasionally added numbers between square brackets indicating positions in this scheme.

[2] Proclus *Elements of Theology* (*ET*), propositions 11–12; 31–6.

[3] Proclus *ET* prop. 29.

[4] The causal process involves three stages: 'every effect remains in its cause, proceeds from it, and reverts upon it' (*ET* prop. 35, trans. E.R. Dodds). See also Beierwaltes 1965, 132, 266–7. For the idea of transference (of power) from the cause to the effect, see *ET* 150, p. 132.1–2 Dodds; Gersh 1973, 65; Siorvanes 1996, 93–4. Procession and production require a combination of likeness and difference, but the likeness is more essential. Cf. *in Parm.* 816.26–30 (δεῖ δὲ τῇ εἰκόνι τῇ ὁμοιότητι συγκεκραμένην ἔχειν τὴν ἀνομοιότητα παντάπασι καὶ αὐτῆς εἶναι γνώριμον, διὰ δὲ τῆς ὁμοιότητος ἐπιστρέφειν πρὸς τὸ παράδειγμα) and 738.35–6 (ἡ πρόοδος αὕτη γίγνεται δι' ὁμοιότητος μᾶλλον ἢ ἀνομοιότητος).

[5] *ET* prop. 14. A more elaborate classification is offered at *Theologica Platonica* (*TP*) 1.14 (p. 60.23–62.1 S.–W.). Both texts draw their inspiration from Plato *Laws* 895a6–b2 and, to a lesser extent, from Aristotle *Phys.* 256a13–b3; cf. Dodds 1963, 201.

[6] *ET* prop. 20, p. 22.16–18: εἰ οὖν ἡ ψυχὴ κινουμένη ὑφ' ἑαυτῆς τὰ ἄλλα κινεῖ, δεῖ πρὸ αὐτῆς εἶναι τὸ ἀκινήτως κινοῦν. νοῦς δὲ κινεῖ ἀκίνητος ὢν καὶ ἀεὶ κατὰ τὰ αὐτὰ ἐνεργῶν. Elsewhere, Proclus uses the superb oxymoron μόνιμος ἐνέργεια to describe the activity of Intellect; e.g., *in Alc.* 208.3–4: ἡ τοῦ νοῦ μόνιμος καὶ διαιώνιος ἐνέργεια. For further examples see Saffrey–Westerink 1997, 29 n. 2.

[7] By 'higher realm' I here mean the Plotinian hypostasis of Intellect, which is designated by the same term 'intellect' in prop. 20 of *ET*. This encompasses the duality of subject (the intellective, intellect in the narrow sense) and object (the intelligible in the narrow sense). Proclus more usually distinguishes three main hypostases within this realm (that may be called 'intelligible' in the broad sense): Being or the Intelligible in the narrow sense [2], the intermediate hypostasis of Life (the Intelligible-Intellective) [3], and Intellect in the narrow sense [4] (one could argue that in *ET* 20 it is precisely the intellective aspect of the higher realm which is the unmoved mover for the soul). This entire realm [2]–[4] corresponds to what Gersh has called 'the spiritual world'. The hypercosmic [5] and even the hypercosmic-encosmic [6] realms can also be considered as belonging to the reality of motionless procession.

[8] See also Gersh 1978, 67–72.

[9] Gersh 1973, 105. Proclus *TP* 1.19, p. 93.16–26.

[10] Gersh 1973, 83 n. 2.

[11] And beyond space, but Proclus especially stresses the contrast – but also the likeness – between time and eternity, as does Plato in the *Timaeus* (37c6–38b5).

[12] Cf. Sorabji 1983, 253–67, 312–13; Brisson–Meyerstein 1995, 21. Proclus actually claims that '(intelligible) life' or 'eternity' [2.2] is the first cause of motion: *ET* p. 92.5–12; Gersh 1973, 78. I presume he can say so because it is the paradigm of time. Interestingly, the level immediately below eternity is equated with the 'eternal living creature', which Proclus indicates as the very first cause of demiurgy. See below, n. 31.

[13] Opsomer 2000, 361–5.

[14] Cf. *Rep.* 509b6–10.

[15] *in Tim.* 1.260.19–26: καὶ μὴν καὶ τῷ αἴτιον εἰπεῖν τὴν ἑνοειδῆ τῆς δημιουργικῆς ἀρχῆς ἐνδείκνυται δύναμιν, αἴτιον καλῶν τὸ δημιουργικόν, οὐχ ἁπλῶς τὸ ὑποστατικὸν ἄλλου· καὶ γὰρ τἀγαθὸν αἴτιον εἶναι τῶν νοητῶν εἶπεν ὁ Σωκράτης· ἀλλ' οὐκ ἔστι δημιουργοῦν, διότι πᾶν τὸ δημιουργοῦν πρὸς γένεσιν ἀποδίδοται, ὡς εἶπεν ἐν Φιλήβῳ τὸ δημιουργοῦν λέγεσθαι πρὸς τὸ γιγνόμενον. ὅθεν καὶ αἴτια πρὸ τοῦ κόσμου ἄλλα ἄλλων, ἀλλ' οὐ δημιουργικὰ τῶν γενητῶν ἐστιν. In the *Philebus*, Socrates explains that one has to distinguish (1) limit, (2) the unlimited, (3) the result of their mixture, i.e. becoming (γένεσις εἰς οὐσίαν), and (4) the cause of the mixture. At 26e–27b he adds that one may substitute τὸ ποιούμενον for τὸ γιγνόμενον, and τὸ ποιοῦν or even τὸ δημιουργοῦν for τὸ αἴτιον. Cf. Proclus *in Tim.* 1.259.27–9; 263.6–19. It should be noted that elsewhere Proclus applies the analysis of the *Philebus* also to the higher forms of production (cf. van Riel 2000).

[16] See n. 7.

[17] *in Tim.* 1.252.11–254.18 (the world of becoming includes the heavens, not because they would not be everlasting, but because they depend upon causes external to them: the heavenly bodies cannot bring about nor sustain themselves; moreover, they are bodily, and *qua* bodily they are not immortal). According to Proclus, the *definition* of these two realms is given in the next sentence (trans. B. Jowett): 'That which is apprehended by intelligence and reason is always in the same state, but that which is conceived by opinion with the help of sensation and without reason is always in a process of becoming and perishing and never really is'. Cf. *in Tim.* 1.240.28–243.25. Interestingly, von Perger in his study of the *Timaeus* (1997, 64–5) deals with questions similar to those raised in Proclus' *Commentary*. Proclus also points out that Plato includes the words 'and perishing' in order to exclude the divine processions (1.241.24–8).

[18] Cf. *in Tim.* 1.241.20–3.

[19] *Tim.* 28a4–6: πᾶν δὲ αὖ τὸ γιγνόμενον ὑπ' αἰτίου τινὸς ἐξ ἀνάγκης γίγνεσθαι· παντὶ γὰρ ἀδύνατον χωρὶς αἰτίου γένεσιν σχεῖν.

[20] *in Tim.* 1.261.23–262.2.

[21] More exactly 'universal demiurgy', as will become clear.

[22] Creation and providence are two aspects of the same activity, as things generated do not have the cause of their existence within themselves and are dependent upon the cause that has created and sustains them. Cf. *in Tim.*

1.259.18–26. This is also why created beings can never be intrinsically immortal – although some of them may never die, they remain dependent upon their cause. This is true for the world as a whole, which has received from its Father a 'contrived immortality' (1.260.14–16; cf. Plato *Pol.* 270a), but also for the young gods. See below.

[23] *in Tim.* 1.262.2–29.

[24] Dillon 2000, 341–2.

[25] *in Tim.* 1.305.19–20: ἔστι γάρ πως καὶ ὁ νοῦς ὁ ἐγκόσμιος δημιουργὸς τοῦ παντός. In Proclus' scheme, this will be the level of the demiurgy of Dionysos, i.e. that of partial or encosmic demiurgy. As a matter of fact, Dionysos will be equated with encosmic intellect (see below).

[26] Opsomer forthcoming[1].

[27] Dillon 2000, 339–43.

[28] Opsomer, forthcoming[1].

[29] *in Tim.* 1.311.5–25.

[30] Most clearly at *Tim.* 39e7–9: ᾗπερ οὖν νοῦς ἐνούσας ἰδέας τῷ ὅ ἔστιν ζῷον, οἷαί τε ἔνεισι καὶ ὅσαι, καθορᾷ, τοιαύτας καὶ τοσαύτας διενοήθη δεῖν καὶ τόδε σχεῖν. See also 47e4–48a2.

[31] The intelligible paradigm is the 'eternal living being', in the Platonic tradition known as τὸ αὐτοζῷον and equated by Proclus with the third intelligible triad [2.3]. For this identification, see Opsomer 2000, 360–2. Proclus also calls it 'the very first cause of all demiurgy'. On the hierarchy of paradigmatic causes, see Opsomer forthcoming[2]. Siorvanes (1996, 89–91) explains the notion of a paradigmatic cause. See also Trouillard 1982, 152.

[32] Cf. *TP* 5.14, p. 49.17–20: καὶ ὅλως ὑπὸ τοῦ Τιμαίου νοῦς μὲν ἀποκαλεῖται καὶ ὁρᾶν καὶ εὑρίσκειν καὶ λογίζεσθαι λέγεται πολλάκις ὁ τῶν ὅλων δημιουργός. Cf. *Tim.* 30b1 (λογισάμενῳ οὖν ηὕρισκεν) and b4; 39e9 (καθορᾷ).

[33] See also *TP* 5.13, p. 42.6–44.17; van den Berg 2000, 428. For a defence of Proclus' interpretation, see Brisson 1994, 64–84.

[34] Dillon's hunch (2000, 344 n. 15) about the analogy between the intellective hebdomad and the seven planets is probably correct. Cf. *in Tim.* 2.197.24–198.14; 212.3–224.3, and especially 268.15–270.3.

[35] Steel 2000, 390–5.

[36] The mixing bowl (ὁ κρατήρ) is actually Rhea, the second divinity of the triad [4.1.2].

[37] Opsomer (forthcoming[1], n. 27), to which one should add the following reference: *De mal. subs.* 15.17–18 Boese ('medii enim potentia, sicut intellectus tertii').

[38] Cf. *TP* 1.15, p. 76.1–4; 1.18, p. 82.8–10; Trouillard 1958, 351; Beierwaltes, 1969, 132. Contrary to the soul, intellect contemplates everything at once and thinks all ideas as one, as Proclus repeatedly states. Cf. *in Alc.* 208.3–5, and esp. *in Parm.* 807.29–808.14 (trans. Morrow–Dillon): 'The divine and demiurgic Intellect contains pluralities in unity, divisible things undivided and distinguishables undiscriminated. Soul is what first separates these contents that exist previously in perfect unity in that Intellect – not our soul only, but the

divine Soul too. For Soul has not been granted thoughts that are established on the level of eternity, but she aims at grasping the full actuality of Intellect; and in her striving for this perfection and for the form of comprehension that belongs to that one and simple being, she circles around Intellect as in a dance, and as she shifts her attention from point to point divides the undivided mass of Ideas, looking separately at the Idea of Beauty and separately at the Idea of Justice, and separately at each of the others, thinking of them individually and not all together.' Cf. Plotinus 6.9 [9] 3.49–54.

[39] *TP* 5.17, p. 62.17–63.5. Cf. *in Tim.* 1.399.20–4.

[40] Cf. *in Tim.* 1.421.2–3.

[41] See also Brisson 1987, 77–9.

[42] *TP* 5.21–6; *in Tim.* 1.315.4–317.20.

[43] *in Tim.* 1.315.15–17: ἐν δὲ τῷ Φιλήβῳ βασιλικὴν μὲν ψυχήν, βασιλικὸν δὲ νοῦν κατὰ τὸν τῆς αἰτίας λόγον ἐν τῷ Διὶ προυπάρχειν ἀποφαινόμενος. Actually, the text of the *Philebus* (30e1–3) reads: ἐν τῇ τοῦ Διὸς φύσει βασιλικὴν μὲν ψυχήν, βασιλικὸν δὲ νοῦν ἐγγίγνεσθαι διὰ τὴν τῆς αἰτίας δύναμιν. Proclus has rephrased these words in terms of his own distinction κατ' αἰτίαν, κατὰ ὕπαρξιν, κατὰ μέθεξιν. For this distinction see *ET* 65; Dodds 1963, 235–6: not only do the characters of the effect pre-exist in the cause (κατ' αἰτίαν – they are first implicit in the cause), they must also exist as fully developed characters inhering essentially in some class of beings (κατὰ ὕπαρξιν – here is their first explicit existence), before a lower order can have them by participation (κατὰ μέθεξιν).

[44] For Proclus' view on the relation between the *Timaeus* and the *Politicus*, see Baltes 1978, 50–1; Dillon 1995.

[45] The 'father' transcends the series of the Kings, the 'makers' are situated at the opposite extreme of this Orphic series. The Orphic Kings are (*in Tim.* 3.168.17–28): Phanes [2.3], Night [3.1], Ouranos [3.2], Kronos [4.1.1], Zeus [4.1.3], Dionysos [at level 7]. Cf. Brisson 1987, 103. Dionysos heads the encosmic demiurges. The One itself [1], though it could be considered the Father of all things, should not be called Father, since it is beyond all names. Cf. *TP* 5.16, p. 54.14–55.13

[46] Cf. *in Tim.* 1.311.25–313.2; *TP* 5.16. The paradigm as a formal cause 'prefigures' the productive cause of the universe: κατὰ μὲν οὖν τὴν θείαν αἰτίαν πατρικὴν ἔλαχεν ἰδιότητα, κατὰ δὲ τὴν εἰδητικὴν τὴν ποιητικὴν προφαίνει τῶν ὅλων ἀρχήν (*TP* 5.16, p. 55.22–4). In other words, it contains the latter κατ' αἰτίαν (as opposed to κατὰ ὕπαρξιν), on which account it is also called the very first principle of demiurgy.

[47] I presume one ought to say that in their case, too, activities follow from their existence (this is even the case for divine souls, who are still much lower; cf. *De mal. subs.* 21–2); see Steel 1978, 70–1. However, since their activities take place in time, their existence is not eternal and is in a sense constituted by their successive activities (even if those are invariable, i.e. even if there were just one identical activity, but not one that is numerically identical).

[48] *TP* 5.16, p. 53.20–6: ὁ μὲν αὐτῷ τῷ εἶναι παράγει, τῆς ἐνεργείας αὐτῷ τελούσης εἰς τὴν ὕπαρξιν, ὁ δὲ τῷ ἐνεργεῖν, τῆς ὑποστάσεως αὐτῷ κατ' ἐνέργειαν

ἱσταμένης. εἰ δὲ αὖ τῶν ἀιδίων καὶ τῶν θνητῶν τὰς ἀπογεννήσεις χωρὶς διελοίμεθα, τὰς μὲν τῶν ἀιδίων ἐπὶ τὴν πατρικὴν αἰτίαν ἀνοίσομεν, τὰς δὲ τῶν θνητῶν ἐπὶ τὴν ποιητικήν.

[49] *TP* 5.13; *in Tim.* 1.310.18–24.

[50] *In Tim.* 1.310.15–18.

[51] *TP* 1.1, p. 18.25–8.

[52] *TP* 6.6, p. 29.6–23; 6.8, p. 37.4–10; 6.9, p. 17–20.

[53] Cf. Proclus *in Tim.* 1.306.1–31 and 309.14–310.2 respectively, and also Opsomer (forthcoming[1)].

[54] See *in Tim.* 1.310.18–22; *in Parm.* 642.20–4.

[55] *TP* 6.6, p. 30.22–31.11.

[56] *TP* 6.6, p. 28.16–18: τὸν ὅλον [...] δημιουργικὸν ἀριθμόν, ὃν κατ' αἰτίαν [...] ἡ δημιουργικὴ περιέχει μονὰς ἐν ἑαυτῇ.

[57] *TP* 6.6, p. 28.23–6: διὰ μὲν τὴν πρὸς μονάδα συνέχειαν τὸ τῆς ποιήσεως εἶδος οὐκ ἐξαλλάττοντες, διὰ δὲ τὴν ὑφειμένην πρόοδον τὸ διατεῖνον ἀμερίστως ἐπὶ πάντα τῆς ἐνεργείας οὐκ ἔχοντες.

[58] *TP* 6.8, p. 35.23–4. The divisions become more complex at the lower levels, but pre-exist in the hypercosmic demiurgic triad: cf. *TP* 6.10.

[59] It is definitely true that the chthonic world is the place of reversion for the souls.

[60] *TP* 6.15, p. 73.17–19: ἄνωθεν μὲν ὑπὸ τῶν ἀρχικῶν ἡγεμόνων ἐνιζόμενοι, κάτωθεν δὲ ὑπὸ τῶν νέων, ὥς φησιν ὁ Τίμαιος, θεῶν εἰς πλῆθος προαγόμενοι.

[61] See *TP* 6.22, p. 97.7–17 for the demiurgic activities of these gods. Neoplatonists were prepared to operate at various levels of complexity in different contexts, as Dillon rightly remarks (2000, 343). In a more simplified account of the theological hierarchy, the intermediate realms (the intelligible-intellective and the hypercosmic-encosmic) could be left out. See Saffrey–Westerink 1981, xxxvi–xxxvii.

[62] See Opsomer 2000 for the notion of 'iconic interpretation' and some hermeneutical applications of the principle of analogy, as well as the textual basis for this principle in the *Timaeus*.

[63] Cf. *in Tim.* 3.152.7–19.

[64] Cf. *in Tim.* 1.404.14–15: πῶς γάρ ἐστιν εἷς ὁ κόσμος, εἰ μὴ νοῦς εἷς ἐν αὐτῷ κρατοίη; In the same passage, Proclus had already asserted that there had to be two intellects, one transcendent and 'unparticipated', the other immanent and 'participated'. 403.31–404.1: ὁ μὲν οὖν Πλάτων πάνυ δαιμονίως νοῦν τε ὑποτίθεται διττόν, τὸν μὲν ἀμέθεκτον καὶ δημιουργικόν, τὸν δὲ μεθεκτὸν καὶ ἀχώριστον. These correspond to the universal and the encosmic demiurges respectively (Zeus, or 'Intellective Intellect', and Dionysos, the 'Intellect of the world'). In the *Timaeus* (30b4) it is said, indeed, that the demiurge creates the intellect which he then places in the soul. The latter intellect must therefore be, according to the categories that are fundamental to Proclus' metaphysics, a participated intellect, whereas the former (the first demiurge) is the imparticipable intellect from which the participated intellect proceeds.

[65] Cf. *in Tim.* 3.168.21–8.

[66] Cf. *in Tim.* 3.327.22–33; *TP* 6.12, p. 63.21–2, and 5.35, p. 127.24–128.2; Damascius *in Phaed.* I 14 (τὸ πλῆθος τῶν θεῶν, οὓς ἀντιστρόφως ὁ Πλάτων 'νέους' καλεῖ, τὸν δὲ βασιλέα αὐτῶν ποιεῖ τὸν Ἥλιον [cf. *Rep.* 509d2–3], ὃς πολλὴν ἔχει πρὸς τὸν Διόνυσον κοινωνίαν διὰ μέσου τοῦ Ἀπόλλωνος κατ' Ὀρφέα).

[67] Damascius *in Phaed.* I 4: διὸ καὶ ἀμέριστος ἅμα καὶ μεριστός· τοιοῦτον γὰρ τὸ πᾶν οἷον ἀθροίσματι μᾶλλον ἐοικὸς καὶ ὁλότητι διακεκριμένῃ τοῖς μέρεσι συνεχόμενον.

[68] *in Tim.* 1.407.21–408.2; 2.146.9–14, 198.2–11.

[69] Damascius *in Phaed.* I 8.

[70] Cf. *in Crat.* 182, 109.9–12; *in Tim.* 1.132.26–30.

[71] See also Damascius *In Phaed.* I 3.

[72] Cf. *in Tim.* 3.163.21–164.4; *TP* 6.18, p. 85.3–4.

[73] *in Tim.* 1.137.7–26; 310.24–6. The more general principle is stated in *in Alc.* 68.16–17.

[74] e.g. *in Tim.* 1.446.5–13; *in Rempublicam.* 2.8.15–23.

[75] Opsomer (forthcoming[2]).

[76] On the demiurgic account of the *Sophist*, see Brague 1991.

[77] Iamblichus *in Soph.* fr. 1 Dillon. See also Charles-Saget 1991, 487–8.

[78] See also Hermias *in Phaed.* 260.22–8, who also draws attention to *Tim.* 59c5–d2: τὴν τῶν εἰκότων μύθων μεταδιώκοντα ἰδέαν· ἣν ὅταν τις ἀναπαύσεως ἕνεκα τοὺς περὶ τῶν ὄντων ἀεὶ καταθέμενος λόγους, τοὺς γενέσεως πέρι διαθεώμενος εἰκότας ἀμεταμέλητον ἡδονὴν κτᾶται, μέτριον ἂν ἐν τῷ βίῳ παιδιὰν καὶ φρόνιμον ποιοῖτο. ταύτῃ δὴ καὶ τὰ νῦν ἐφέντες τὸ μετὰ τοῦτο τῶν αὐτῶν πέρι τὰ ἑξῆς εἰκότα δίιμεν τῇδε. Cf. *Soph.* 236a4–6: ἆρ' οὖν οὐ χαίρειν τὸ ἀληθὲς ἐάσαντες οἱ δημιουργοὶ νῦν οὐ τὰς οὔσας συμμετρίας ἀλλὰ τὰς δοξούσας εἶναι καλὰς τοῖς εἰδώλοις ἐναπεργάζονται;

[79] A few examples may suffice: the creation of body is the task of Adonis, but also falls under Dionysos' responsibility; both gods supervise regeneration and palingenesis; the demiurgy of both of them is called a game. See Opsomer (forthcoming[2]).

[80] Cf. *TP* 5.16 p. 53.21–3 and n. 47. See also *in Tim.* 3.316.21–317.24, especially 316.26–9: καὶ εἰ ὁ μὲν ἐν ἑαυτῷ μένει, κινοῦνται δὲ οὗτοι περὶ αὐτόν, δῆλον, ὅτι διαιωνίως μὲν ἐκεῖνος αἴτιός ἐστι τῶν κατὰ χρόνον ὑφισταμένων, οὗτοι δὲ πληρούμενοι παρ' αὐτοῦ κατὰ τὸν ὅλον ἐνεργοῦσι χρόνον. There is no inconsistency with the axiom that soul is the first 'moved mover' (cf. *supra*), since the encosmic gods do have souls. Cf. *in Parm.* 817.4–819.29; *in Tim.* 3.231.5–26; 260.7–23 and esp. 205.15–24 and 315.19–316.14.

[81] The crucial question is how they can – through intermediary causes – produce anything unlike themselves at all. The standard reply imputes this to declension, but logically this should only account for a *lesser* resemblance, and not for the presence of an opposite property. See, however, *TP* 6.4, p. 24.17–20: καὶ τὰ ἐναντία καὶ πλεῖστον ἀλλήλων ἀφιστάμενα λόγοις ἀνελέγκτοις συνδεῖ [*sc.* ἡ ὁμοιότης] καὶ πρὸς τὴν τοῦ παντὸς συμπλέκει τελειότητα.

[82] *in Tim.* 3.317.24–318.4.

[83] See notes 43 and 64.

[84] Cf. *in Tim.* 3.228.26–8: ποιεῖ γάρ, ἀλλὰ διὰ τῶν νέων θεῶν· πρὶν γὰρ οὗτοι ποιήσουσιν, ἐκεῖνος πεποίηκε τῷ νοῆσαι μόνον. See also 3.222.2–5 and especially 3.225.26–31: κἀκεῖνο δὲ ἀκριβῶς εἴρηται τὸ δι' ἐμοῦ (*Tim.* 41a7; c2)· καὶ γὰρ τὰ θνητὰ τῶν γενῶν ὑπ' αὐτοῦ γίγνεται, δι' αὐτοῦ δὲ τὰ ἀίδια· κατὰ μίαν γὰρ αἰτίαν ἡνωμένην ἔχει τό τε ὑφ' οὗ καὶ τὸ δι' οὗ, καὶ ὡς μὲν πατὴρ ὑφ' ἑαυτοῦ πάντα ποιεῖ, ὡς δὲ δημιουργὸς τὰ ἀίδια μὲν δι' ἑαυτοῦ, τὰ δὲ θνητὰ διῃρημένως ὑπ' αὐτοῦ μέν, διὰ τῶν νέων δὲ γίγνεται θεῶν.

[85] *TP* 5.18, p. 69.20–1: τὰ δὲ θνητὰ διὰ τῶν νέων κυβερνᾷ θεῶν, ἀφ' ἑαυτοῦ μὲν καὶ ταῦτα γεννῶν, ἀλλ' οἷον αὐτουργούντων ἄλλων.

[86] *in Tim.* 3.228.20–5: μηδὲ ἐπιζητῶμεν <τὴν> ἰδέαν Σωκράτους ἢ Πλάτωνος ἢ τῶν καθ' ἕκαστά τινος· κατὰ γένη γὰρ ὁ δημιουργὸς καὶ τὰ θνητὰ ζῷα διεῖλε καὶ μέχρι τῶν ὁλικῶν ἵσταται νοήσεων καὶ διὰ τούτων περιλαμβάνει πᾶν τὸ μερικόν· ὡς γὰρ τὸ ἔνυλον ἀύλως καὶ τὸ γενητὸν ἀγενήτως, οὕτω καὶ τὸ καθ' ἕκαστον ὁλικῶς προείληφε.

[87] Forms (those that exist in intelligible intellect [2.3] as well as those in intellective intellect [4.1.3]) are also efficient causes according to Proclus.

[88] *in Tim.* 3.230.17–19: τὸ δὲ λοιπὸν ὑφίστησι μέν, ἀλλὰ προσεχῶς τοῖς νέοις θεοῖς παραδίδωσιν αὐτοῦ τὴν ἀπογέννησιν καὶ ἐκείνους κυρίους ἀποφαίνει τῆς θνητῆς ἁπάσης φύσεως.

[89] *in Tim.* 3.310.28–311.3 (*OF* 207 Kern); *in Crat.* 105, 55.5–11 (*OF* 208 Kern).

[90] *in Tim.* 3.311.13–16: οὕτως οὖν νέοι λέγονται, ὡς τῷ χρόνῳ συμπαρατεινομένην λαχόντες τὴν ὑπόστασιν καὶ ἀεὶ γιγνόμενοι καὶ ἐπισκευαστὴν ἀθανασίαν ἔχοντες.

[91] *in Tim.* 3.311.6–12.

[92] *Tim.* 41a7–b7: Θεοὶ θεῶν, ὧν ἐγὼ δημιουργὸς πατήρ τε ἔργων, ἃ δι' ἐμοῦ γενόμενα ἄλυτα ἐμοῦ γε ἐθέλοντος. τὸ μὲν οὖν δὴ δεθὲν πᾶν λυτόν, τό γε μὴν καλῶς ἁρμοσθὲν καὶ ἔχον εὖ λύειν ἐθέλειν κακοῦ· δι' ἃ καὶ ἐπείπερ γεγένησθε, ἀθάνατοι μὲν οὐκ ἐστὲ οὐδ' ἄλυτοι τὸ πάμπαν, οὔτι μὲν δὴ λυθήσεσθέ γε οὐδὲ τεύξεσθε θανάτου μοίρας, τῆς ἐμῆς βουλήσεως μείζονος ἔτι δεσμοῦ καὶ κυριωτέρου λαχόντες ἐκείνων οἷς ὅτε ἐγίγνεσθε συνεδεῖσθε. νῦν οὖν ὃ λέγω πρὸς ὑμᾶς ἐνδεικνύμενος, μάθετε. See Festugière 1968, 66 n. 1; Cornford 1937, 367–70.

[93] *in Tim.* 3.198.4–9.

[94] *Tim.* 41b7–c2: τὰ γὰρ ἅπαντ' ἐν αὐτῷ γένη ζῴων οὐχ ἕξει, δεῖ δέ, εἰ μέλλει τέλεος ἱκανῶς εἶναι. c3–4: ἵνα οὖν θνητά τε ᾖ τό τε πᾶν τόδε ὄντως ἅπαν ᾖ. Cf. *in Tim.* 3.227.13–21; 241.22–3.

[95] *in Tim.* 3.198.19–29: δεῖ γὰρ τὰ μὲν πρώτως ἀπογεννᾶσθαι παρὰ τῆς δημιουργικῆς μονάδος, τὰ δὲ διὰ μέσων ἄλλων, τοῦ μὲν δημιουργοῦ πάντα παράγοντος ἀφ' ἑαυτοῦ καὶ ὁμοῦ καὶ διαιωνίως, τῶν δὲ παραγομένων τάξιν ἐχόντων, καὶ τῶν πρώτων προϊόντων συμπαραγόντων ἐκείνῳ τὰ μεθ' ἑαυτούς, οἷον τῶν μὲν οὐρανίων τοὺς ὑπὸ σελήνην, τούτων δὲ τὰ θνητὰ ζῷα, κἀκείνου μετ' αὐτῶν ταῦτα παράγοντος (ἐν γὰρ τῷ λέγειν πάντα νοεῖ, τῷ δὲ νοεῖν ποιεῖ καὶ τὰ θνητὰ γένη τῶν ζῴων), ἐκείνων δὲ ἄλλης δεομένων προσεχοῦς γεννητικῆς αἰτίας καθ' ὅσον ἐστὶ θνητὰ καὶ δι' ἐκείνης τὴν εἰς τὸ εἶναι πάροδον δεχομένων.

[96] It will be evident that Proclus' distinction between procession and demiurgy does not correspond to the difference between emanation and creation, if one understands these terms as Gerson does. But then, there is no need to do so. However, even if one were to define creation otherwise and take it as implying a choice, with the real possibility of a different choice – as opposed to emanation where one principle by necessity and motionlessly produces the next, Proclean demiurgy could not be labeled as creation so as to contrast it with emanation: universal demiurgy does not imply such choices, while encosmic production does. Demiurgy is at any rate just a special form of procession, although Proclus avoids using the term procession for the lowest levels of demiurgy, such as its sublunary forms. The verb ὑφίστημι, from which ὑπόστασις is derived, is used for all forms of production, from that of the One downwards to the last productive realities. On creation and emanation, see also Trouillard 1981; Beierwaltes 1965, 143–6.

[97] One more complication: the causal efficacy of the earlier members of the causal series extends further down the ontological scale. Whereas the highest principle (the One) produces even the lowest reality (matter), the influence of the lower causes in the series reaches decreasingly less far down. This means that A will produce Z (Z being the last product), but B will not (therefore matter has existence, but no being). Take, e.g., the triad Being [2], Life [3], Intellect [4]: more things participate in being than there are things that have life, and even fewer have intellect. This doctrine is a post-Plotinian development, yet definitely older than Proclus, cf. Syrianus *in Metaph.* 59.17–18; Procl. *ET* prop. 57; Dodds 1963, 230–2.

[98] *in Tim.* 3.250.6–10.

[99] *in Tim.* 3.213.30–214.35; 215.6–218.21.

[100] They are αὐθυπόστατα. See Gerson 1973, 128–35.

[101] Opsomer 2000, 366.

[102] Elsewhere Proclus calls this a 'contrived immortality', referring to Plato's *Statesman*: *TP* 5.18, p. 67.25 (τὴν ἐπισκευαστὴν ἀθανασίαν) on *Pol.* 270a4.

[103] *in Tim.* 3.218.27–8: τὸ δ' ἀθάνατοι μὲν οὐκ ἐστὲ οὐδὲ ἄλυτοι δηλοῖ, ὅτι γίγνεσθε ἀθάνατοι καὶ ἄλυτοι.

[104] *in Tim.* 3.218.23–7.

[105] Cf. *in Tim.* 3.216.13–20.

[106] 41c2–3: δι' ἐμοῦ δὲ ταῦτα γενόμενα καὶ βίου μετασχόντα θεοῖς ἰσάζοιτ' ἄν.

[107] Cf. *ET* prop. 76: πᾶν μὲν τὸ ἀπὸ ἀκινήτου γινόμενον αἰτίας ἀμετάβλητον ἔχει τὴν ὕπαρξιν· πᾶν δὲ τὸ ἀπὸ κινουμένης, μεταβλητή. Cf. also prop. 172.

[108] *in Tim.* 3.225.4–9.

[109] *in Tim.* 3.224.4–6, 225.12–13.

[110] *in Tim.* 3.230.34–231.2.

[111] *in Tim.* 3.225.9–11: δέχεται γὰρ ἀπὸ μὲν τῆς ἀκινήτου τὸ ἕν, ἀπὸ δὲ τῆς κινουμένης τὸ πλῆθος, καὶ ἀπὸ ἐκείνης μὲν τὸ εἶναι καὶ τὸ εἶδος, ἀπὸ δὲ ταύτης τὸ ἄτομον καὶ τὸ γενέσθαι.

[112] See also 69c5: οἱ δὲ μιμούμενοι.

[113] *in Tim.* 3.312.2–4.

[114] *in Tim.* 2.217.20–21.

[115] One can understand how motion is analogous to spiritual motion, and time to eternity (cf. Opsomer 2000), and how they 'mirror' each other as image and model, but not how the one is caused by the other, at least not according to the Neoplatonic conception of causation, in so far as the latter entails similarity between cause and effect.

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8

ZOOGONY AND EVOLUTION IN PLATO'S *TIMAEUS*: THE PRESOCRATICS, LUCRETIUS AND DARWIN

Gordon Campbell

> Apparently there is no limit, Joe remarked. Anything can be said in this place and it will be true and will have to be believed.
>
> Flann O'Brien *The Third Policeman* 1967, 74

> Modern critics may try to figure themselves as disinterested scientists viewing ancient texts 'with the shutter open' and simply describing what they find, but in reality we are like Aeneas before the pictures in Carthage, seeing what we want to see and telling a story. Our gaze on the past is always 'the view from somewhere'.
>
> Don Fowler, *Roman Constructions*, p. ix.

There can be few more influential works on cosmogony and zoogony than Plato's *Timaeus*. Indeed a good case can be made for including *Timaeus* as one of the four most influential books on the subject, along with *Genesis*, Lucretius' *De rerum natura* and Darwin's *On the Origin of Species*. The relationship between these four books is complicated and involved, and, apart from *Genesis* perhaps, each has been written in the context of the others, if not entirely as a polemical rebuttal of the others. That is to say the directionality of intertextual reference between them is not simple, and will often be the reverse of what we should expect.[1] The later of the two works of Greek philosophy, the *Timaeus*, may be viewed in some sense as a reply to the ideas contained in the earlier *De rerum natura*, since it is clear that to a considerable degree *Timaeus* is a polemic against the earlier cosmologies of Empedocles and Democritus, and Lucretius follows the Epicurean atomistic tradition derived from Democritus, and is also strongly influenced by Empedocles. But Epicurus, and therefore Lucretius, could not ignore Plato's *Timaeus* and its influence in the Hellenistic period, and so *De rerum natura* is in its turn partly an anti-Timaean polemic.[2] Similarly, since our ideas are so strongly influenced by Darwin, whether

we like it or not, when thinking about evolution we can hardly expect ancient texts to be our sole source texts – Darwin will often become our source text, and ancient texts the target texts. Further, although Darwin's knowledge of ancient ideas of evolution seems to have been slight, *Origin of Species* can be seen as a belated continuation of an ancient mechanistic scientific tradition, and so another complication is added.[3]

I. Lucretius' zoogony

In order to place Plato's *Timaeus* in its ancient context, then, and attempt to disentangle some of the threads of interaction between *Timaeus*, Lucretius and Darwin, I must begin at the wrong end of antiquity with Lucretius' scheme of zoogony and adaptation in *De rerum natura* 5. I shall examine Lucretius' zoogony in some detail since it represents the continuation and culmination of a Greek scientific tradition that *Timaeus* cuts across and interrupts; it is the only detailed account of the atomistic mechanism of adaptation, which is one of Plato's targets for subversion in *Timaeus*.[4] So, if it sometimes seems that I present *Timaeus* as if arguing against Lucretius, and if Darwin and Lamarck appear to interact diachronically with Lucretius and Plato, it will be, although anachronistic, not too far from the truth. This process of contextualization takes some time, and so I hope the reader will bear with me and persevere until I finally get to *Timaeus*. Like Darwin and the Presocratics, including the atomists, I am mainly concerned here with the mechanisms of the origin of species, and so if I examine *Timaeus* in a thoroughly un-Platonic mechanistic way, I hope Platonic scholars will forgive me. I use the term 'evolution' broadly, to describe (1) 'inter-specific evolution' – the Darwinian model of the origin of species by the gradual accumulation of variation over time leading to the formation of new species, and (2) 'intra-specific evolution' – the accumulation of variation within a species that stops short of crossing species boundaries. I argue that the former is not found in ancient scientific thinking except in *Timaeus*, but that the latter, evolution within fixed species boundaries, is standard in ancient thinking. My approach is informed by my conviction that ancient ideas should not only be studied as exhibits in a museum of the history of 'wrong' ideas, but as living and valuable contributions to a debate that is as topical now as it ever was. The benefits may be twofold in that we may reach a better understanding of both ancient and modern ideas if we understand the source of our preconceptions.

Lucretius describes the creation of the world in *De rerum natura* 5.416 ff. as the result of random collisions of a large number of atoms over a long period of time.[5] Given a large enough supply of atoms and

long enough time, it is inevitable that enough fruitful collisions will take place to produce the atomic compounds that will eventually form a world. The process is entirely chaotic, subject to no plan, design, intelligence, or control (5.419–21), and is governed only by the limit on the number of possible types of atomic combinations, which ensures the regularity of the phenomenal world.[6]

This process of creation by random combinations of atoms is mirrored by the creation of life in 5.772 ff.[7] We are not given here a microscopic atomic explanation of zoogony, and this must be supplied from 2.700 ff. The random nature of creation is, however, described in macroscopic terms at 5.837 ff. where the earth is said to create many monsters (*portenta* 837) at the same time as viable creatures.[8] It is clear that no pre-existing pattern for life is available for the earth to follow in her creation. She throws up creatures at random; some without gender (*androgynem*, 839); some without eyes (*sine vultu caeca*, 841); some without feet (*orba pedum*, 840); without hands (*manuum viduata*, 840); without mouths (*muta sine ore*, 841); and some with their limbs not properly separated from their bodies and so unable to move (*vinctaque membrorum per totum corpus adhaesu*, 842).

Clearly, these creatures will die out very quickly. Some will be eaten by others (*nec vitare malum*, 844), some will starve (*nec sumere quod foret usus*, 844, *nec reperire cibum* 848) and all of them will be prevented from breeding, either by lack of the proper organs or by dying before they have a chance, and so will be unable to found a species (*procudere saecla*, 850). Thus we have a scheme of individual extinctions in the first generation of creatures produced spontaneously from the earth. We may assume that Lucretius' list of *portenta* is not exhaustive. If the earth produces creatures without a pattern for life, then anything is possible. We may imagine many other creatures that come together in ways that prevent them living for more than a few moments, perhaps without other essential organs or simply with their organs and limbs wrongly arranged.

The purpose of this scheme of extinctions is clear. It explains the adaptation of animals to their environment without the need for an overarching vitalistic or organizing force to design creatures and to divide them into species. All possible animals came into being at the same time at the beginning of the world, but only some of them were viable, and so were able to breed and continue their line; the others simply died out. Thus we have an anti-teleological scheme of adaptation and the origin of species that denies the operation of providence in the 'design' of animal life of the sort found in Cicero *De natura deorum* 2.120–53,[9] where the Stoic Balbus uses the apparently perfect conformation of creatures and

their perfect adaptation to their environment as proof of the care of Providence for the world.

However, Lucretius in book 5 does not rely upon these extinctions alone to account for adaptation. At 5.855 ff., we are given a second explanation of adaptation by extinctions. Here Lucretius describes the extinctions of entire species (*saecla*, 855)[10] rather than simply of individual creatures. We must assume that these creatures are viable in themselves and that they are able to find food and to breed, but they die out because they do not have particular physiological or behavioural characteristics to enable them to survive in a competitive struggle for life. We are told that lions survive because of their boldness and strength (*virtus*), foxes because of their cunning (*dolus*), and deer because of their speed in flight (862–3). These qualities enable them to compete and flourish in a survival of the fittest. Lucretius also includes (5.923–4), as we should expect in an Epicurean account, survival by co-operation. He gives the example of the mutually beneficial symbiotic relationship between humans, dogs, horses and sheep (864–70). The dogs, sheep and horses avoid the competition of the struggle for life by the protection and food given them by humans.[11]

The function of this second phase is not immediately as clear as that of the first. Lucretius has already removed maladapted creatures, and explained the formation of species. However, it seems clear that the extinctions of the *portenta* would account only for broad adaptations, such as having usable limbs. Creatures unviable in themselves because of some fundamental flaw in their make up would die out, but fine adaptations such as the positioning of the eyes on the front of the head, the number of eyes, the number of digits on a hand, and such adaptations as teeth being sharp at the front of the mouth and blunt at the back[12] could not be accounted for in this way. Animals with a reversed tooth configuration could still eat, and having eyes at the back of the head or seven digits would not, on their own, prevent a creature from surviving. Accordingly, extinction by competition becomes necessary. Animals with reversed teeth would not be as successful as those with 'normal' teeth, and so would become extinct in competition for food resources, and in this way the fine adaptation of animals to their environment is explained. To use Lucretius' examples: lions (or creatures who compete with lions) with lesser strength would die out and so the lion's great strength is explained. Creatures with lesser speed than deer would be caught and eaten, and so the speed of the deer is explained. We may imagine a great range of different creatures with different attributes in Lucretius' early world, but only those with the 'correct' attributes and adaptations (the species we see today) would survive. All the others have become extinct. The seeming providential

design of animals, fitting them perfectly for their role in life, is refuted and replaced by a non-teleological process of the interaction of chance and necessity.

This scheme of adaptation by extinctions has led to comparison with the scheme of Darwin and to the assumption that Lucretius is presenting an evolutionary view of adaptation. However, there are fundamental differences between the two. Most importantly, Lucretius insists on the fixity of species. All the 'mutations' necessary to provide the variety of creatures for natural selection to work upon and produce close adaptations of animal form and function to environment, occur in one great burst at the beginning of the world. As soon as creatures begin to breed by sexual reproduction species become fixed, and it is sexual reproduction that ensures species remain permanently fixed and unable to mutate.[13] We do not have the Darwinian reliance on the mutation of creatures from generation to generation due to sexual reproduction, which fits them ever more nearly perfectly for their role in life. Clearly Lucretius is attempting to account for the perceived regularity of nature rather than arguing against it as Darwin does.[14] In this way, Lucretius' scheme of the origin of species is not only anti-teleological but also anti-evolutionary.

II. Empedocles' zoogony

Lucretius' zoogony is the culmination of a scientific tradition. The details of other Greek scientific theories of adaptation are few, but Empedocles provides us with the other main scientific account of the creation and adaptation of life. It is unfortunately fragmentary and many different interpretations are possible. However, I feel it is safe to say that Empedocles' scheme is significantly similar to that of Lucretius. Empedocles has a double cosmic cycle in which two cosmic forces, Love and Strife, each have both a creative and destructive role, alternately creating and destroying life, and so we have two zoogonies, one under Love and one under Strife.[15] We have only one fragment of the zoogony under Strife (fr. 62), but the zoogony under Love is preserved in some detail. Strasbourg fragment a(ii) 23–30[16] and fragments 57, 59, 61, and 71 give us:

> I will show you to your eyes too, where they (i.e. the elements) find a larger body: first the coming together and the unfolding of the stock, and as many as are now remaining of this generation, on the one hand among the wild species of mountain-roaming beasts, and on the other hand the twofold offspring of men,[17] and in the case of the produce of the root-bearing fields and of the cluster of grapes mounting on the vine. From these accounts convey to your mind unerring proofs: for you will see the coming together and unfolding of the stock.
>
> (Strasbourg fr. trans. Martin and Primavesi, 1999, 139)

> Here many heads sprang up without necks, bare arms were wandering without shoulders, and eyes needing foreheads strayed singly. (fr. 57)

> But as god mingled further with god they fell together as they chanced to meet each other, and many others in addition were continually arising. (fr. 59)

> Many creatures with a face and breasts on both sides were produced, man-faced bulls arose and again bull-headed men, [others] with male and female nature combined, and the bodies they had were dark. (fr. 61)

> But if your belief about these things in any way lacked assurance, how, from the combining of water, earth, air and sun came the forms and colour of mortal things which have now arisen, fitted together by Aphrodite...
> (fr. 71, trans. Wright; cf. Wright ad loc., Furley, 1987, 94 ff.)

For an interpretation of this scheme of zoogony, I turn to Aristotle and his commentator Simplicius. Aristotle discusses and rejects Empedocles' theory at *Physics* 2.8, 198b16–32, in a passage which quotes part of Empedocles fragment 61:

> So here the question rises whether we have any reason to regard nature as making for any goal at all, or seeking any one thing as preferable to another. Why not say, it is asked, that nature acts as Zeus drops the rain, not to make the corn grow, but of necessity (for the rising vapour must needs be condensed into water by the cold, and must then descend, and incidentally, when this happens, the corn grows), just as when a man loses his corn on the threshing-floor, it did not rain on purpose to destroy the crop, but the result was merely incidental to the raining? So why should it not be the same with natural organs like the teeth? Why should it not be a coincidence that the front teeth come up with an edge, suited to dividing the food, and the back ones flat for grinding it, without there being any design in the matter?[18] And so with all other organs that seem to embody a purpose. In cases where a coincidence brought about such a combination as might have been arranged on purpose, the creatures, it is urged, having been suitably formed by the operation of chance survived; otherwise they perished, and still perish, as Empedocles says of his 'man-faced oxen'.
> (Trans. Wicksteed and Cornford)

Simplicius (*in Phys.* 371.33–372.11) comments on this Aristotelian passage as follows:

> Thus Empedocles says that under the rule of love parts of animals first came into being at random – heads, hands, feet and so on – and then came into combination: 'There sprang up ox progeny, man-limbed, and the reverse' (obviously meaning 'man progeny ox-limbed', i.e. combinations of ox and man). And those which combined in a way which enabled them to preserve themselves became animals, and survived, because they fulfilled each other's needs – the teeth cutting and grinding the food, the stomach digesting it, the liver converting it into blood. And the human head, by combining with the human body, brings about the preservation of the whole, but by combining with the ox's body fails to cohere with it and perishes. For those which did not combine on proper principles perished. And things still happen the same way nowadays. This doctrine seems to be shared by all those early natural philosophers who make material necessity the cause of things' becoming, and, among later philosophers, by the Epicureans.
> (Trans. Long and Sedley)

Simplicius makes it clear that Empedocles is putting forward a scheme of creation and adaptation by the chance assemblage of disparate parts of creatures, with Love as a cohesive force. The assembly of the correct parts produces a viable creature, while incorrect assembly ensures the immediate destruction of the creature, and so adaptation is accounted for, just as in Lucretius, by the extinction of maladapted forms.[19] Thus the two schemes are essentially the same: animals arise at random without a pre-existing pattern for life or any guidance, whether divine or biological, about how they should fit together. So Empedocles' scheme is anti-teleological,[20] and relies upon a similar combination of chance and necessity to produce species as does that of Lucretius. Empedocles' scheme has also been described as an evolutionary one, but, as with Lucretius, it seems that he is attempting to account for the regularity of species rather than describing mutation between species. Again, all his mutations occur at the beginning of the world, and all except viable species die out immediately. This ensures his theory is non-evolutionary.

Simplicius' statement that the same thing happens 'even today' is a reference to Empedocles' embryology,[21] which is conceived of in similar terms to his zoogony, with each organ and limb of the parents providing a miniature pre-formed copy of itself. These are then assembled to form the embryo. This, given the traditional analogy between cosmogony, zoogony and embryology (Furley 1989, 229 ff.), makes it easier to understand Empedocles' idea of the original formation of creatures by the coming together of separate limbs. The main difference between Lucretius' and Empedocles' theories is that Empedocles' creatures are assembled, however randomly, from ready-made parts, while Lucretius' creatures are formed randomly at the atomic level. The role of Love (Aphrodite in fr. 71.4, Kypris in fr. 73.1) in combining the parts of creatures may seem to suggest divine teleology, but it is clear that Love is not an organizing principle but merely a force of attraction, since she is unable to choose the correct parts to fit together. Against this may be brought fragment 84 in which

Empedocles describes Aphrodite constructing the eye for the *purpose* of seeing, i.e. in teleological terms.[22] However, the eye with its complexity presents probably the greatest challenge to any anti-teleological account of adaptation, and it is difficult to see how else its creation could be described without an idea of its gradual evolution; even in modern theory the evolution of the eye has been problematic, and is still one of the favourite targets for creationists. Further, modern biology is riddled with teleological language and explanations just as much as ancient biology was, and teleology is even thought of as a useful explanatory device, although few biologists would really accept any form of goal orientation in evolution.[23] For both these reasons, therefore, Empedocles still may be still regarded as an anti-teleologist.

Simplicius ends with the claim that this is a scheme of adaptation common to all the ancient physicists who have material necessity as the cause of generation, and specifically attributes it to the Epicureans. This would place the Epicureans along with Empedocles in a tradition of Greek anti-teleological mechanistic zoogony in which creatures arise by chance and are then adapted by necessity, in the form of extinctions.[24] The striking point in Aristotle's comments is his assumption that Empedocles' system would account for fine adaptations such as the configuration of the teeth.[25] As I have said above, it seems that the simple extinctions of essentially unviable maladapted forms alone could not account for this. We cannot know whether Empedocles expanded on his theory with a second round of extinctions by competition, as Lucretius does, and thus accounted for fine adaptations,[26] but adaptation by natural selection in a struggle for life is not unique to Lucretius in ancient literature. It is found also in the Hippocratic *On Ancient Medicine* 3.26, where the writer gives an anti-primitivistic account of human origins, claiming that the first humans cannot have been healthy, given their wild, spontaneously produced, diet of grasses and roots, and that the majority of them, the weaker, died out leaving only the stronger to pass on their tough constitutions; in this way we have been progressively toughened and adapted to our environment by extinctions. But this seems to represent only one strand of medical thought on the subject. The Peripatetic Dicearchus (fr. 49 Wehrli) claims, on the contrary, that the most eminent medical writers considered that the first humans were tougher and less subject to disease than their own contemporaries.[27]

III. Other Presocratic zoogonies

The schemes of adaptation outlined above have been shown to be non-evolutionary, since they describe a process that takes place in the context

of species stability. Species come into existence in their present form rather than, as in the Darwinian and Lamarckian theories, starting as simple creatures which then become more complex as they evolve. There seem to be few hints that any ancient thinker, other than Plato in the *Timaeus*, conceived an evolutionary theory of the origin of species. It is mainly the Presocratic philosopher Anaximander who is reported to have held what sounds like an evolutionary theory. Hippolytus (*RH* 1.6.6, DK12 A11) reports that Anaximander believed:

> Originally the human being was similar to another creature – that is to a fish.
> (Trans. K.R.S. with alterations).

However, this suggestion that humans had evolved from animals in Anaximander's zoogony is somewhat undermined by other reports of his views, for example Censorinus 4.7 (DK12 A30):

> Anaximander of Miletus believed that there arose from water and earth heated either fish or creatures very like fish: in these humans grew, and the embryos were retained inside them until puberty; then at last the fish-like creatures burst, and men and women who were already able to nourish themselves stepped forth. (Trans. K.R.S.).

Censorinus makes it clear that Anaximander's first humans have not evolved from fishes, but are merely protected inside them. Since Anaximander's view seems to have been that all life arose in water, such an expedient to account for the survival of land animals would be forced upon him.[28] Indeed this idea of the first humans being protected inside fishes points strongly to the conclusion that Anaximander envisaged that species had arisen in the traditional way, fully formed by spontaneous generation. There is a strong similarity to Lucretius' use of wombs rooted to the earth in which the first humans grow (5.807 ff.). This would seem to be forced upon Lucretius by a similar need to account for the survival of helpless infants born directly from the earth.[29] So it would appear that Anaximander did not have an evolutionary view of the origin of species.[30] However, it may be important to note that Hippolytus describes the original fish-like state of humans in a matter of fact way, and so the idea of human evolution from animals may have been current.

The extant fragments of the other Presocratics do not describe the mechanism by which creatures are adapted into species, but they all seem to present a theory of the origins of life similar to that of Anaximander: the spontaneous generation of life from a mixture of water and earth in the presence of heat.[31] It may therefore be reasonable to assume that, as Simplicius claims, the standard mechanism was similar to that found in Empedocles and Lucretius, of the earth generating creatures at random,

which are then formed into species by the extinctions of maladapted forms. One of the striking features of these Presocratic theories is that humans and animals are given the same origins, as in Archelaus:[32]

> On the subject of animals [Archelaus] holds that, when the earth was originally getting warm in the lower region, where the hot and the cold were mingled, many animals began to appear including humans, all living the same manner of life and all deriving their nourishment from the slime. But this continued only for a short time; afterwards arose the mode of birth in which one animal is produced from another. And humans were differentiated from the other animals, and so rulers and laws and arts and cities and the like arose. But mind, he says, is inborn in all animals alike. For each of the animals, as well as humans, makes use of mind, though some more rapidly than others. (Trans. K.R.S. with alterations)

Hippolytus does not give us any details of Archelaus' method of the differentiation of humans and animals, but it is clear that humans are regarded as simply another animal species, and we may presume that the differentiation arises, at least in behaviour if not in physiology, from the human possession of mind in greater measure than other animals. This would seem to be an anti-teleological view of creation and the evolution of society, and this is what we should expect from a zoogony that makes little distinction between humans and animals. On the other hand a clear divide is often associated with a teleological view of the world and the assumption of a 'Great Chain of Being' in which each creature has a fixed place in a hierarchy that exists for a purpose, whether divine or biological.[33]

IV. Human evolution in Lucretius, Lamarck and Darwin

The closeness of the first humans and animals in both behaviour and physiology is a common theme of anti-primitivist or hard-primitivist prehistories.[34] Generally, the acquisition of arts and technologies, whether granted divinely or acquired by human ingenuity through trial and error, increases the differentiation between humans and animals, and leads to the formation of a human race recognizably different from one that was previously not clearly distinguished from the animals.

This process of becoming fully human is also seen in Lucretius 5.1011–27:

> *inde casas postquam ac pellis ignemque pararunt,*
> *et mulier coniuncta viro concessit in unum*
> *conubium, prolemque ex se videre creatam,*
> *tum genus humanum primum mollescere coepit.*
> *ignis enim curavit ut alsia corpora frigus*
> *non ita iam possent caeli sub tegmine ferre,*

> *et Venus imminuit viris puerique parentum*
> *blanditiis facile ingenium fregere superbum.*
>
> *post* 1012 *lacunam indicavit Marullus*
> 1013 conubium *Lachmann*: cognita sunt *OQ*

> Then after they got themselves huts and skins and fire, and woman was joined to man and retired into a single marriage, and they saw that children were created from them,[35] then the human race first began to soften. For fire saw to it that their tender bodies were unable to bear the cold under the open sky as they had before, and love lessened their violence,[36] and children with their winning ways easily broke the arrogant nature of their parents.

From 5.925 Lucretius had described the first humans (*genus humanum… illud* 'that human race' 925) as physically tougher, stronger, less susceptible to heat, cold or disease, and physically beast-like (*saetigerisque pares subus* 'like bristly boars' 970). They live a 'beast-like life'[37] without any arts or technologies, co-operation, marriage or society. Then (at 5.1011) they procure for themselves houses, skins and fire, and begin to live a settled existence with marriage, children, and family life. This leads to a softening, both physical and psychological, that enables them to begin to co-operate with one another and develop the first societies and language. Thus we have here an evolutionary change in human physiology and psychology, but one that comes about in quite a different way from what might be expected, given the scheme of adaptation by extinctions in 5.837 ff. There we saw some of the elements of a seemingly Darwinian scheme of adaptation, but set in the context of species stability. Here Lucretius' early humans evolve in response to their changing environment, but they are still unable to cross the species barrier imposed by the atomic laws of nature (*foedera naturae*); they evolve but remain within their own species. This explains the emergence of fully modern humans from an earlier, more 'primitive' human race, which was however still human – it emerged from the ground fully formed, and did not evolve from animals. This race becomes physically softer due to the effects of fire, softer psychologically from the effects of love and child care, and then, we must assume, these acquired characters are passed on to the offspring, who are born as fully modern humans. Such a mechanism of evolution is closer to that of Lamarck than of Darwin. In Lamarck's system creatures evolve by passing on to their offspring characters they have acquired during their lifetimes by responding to environmental change.[38] The giraffe, for example, has evolved its long neck as a result of parent giraffes stretching up to eat high leaves, thus lengthening their necks slightly. They then pass on this acquired extra neck length to their offspring, who are born with

slightly longer necks than their parents had been. They then repeat the process, and so on from generation to generation until we get the very long necked giraffes of today (*Philosophie Zoologique* 1.256–7). As Lamarck says (1.221):

> I could prove that it is not at all the form either of the body or its parts that gives rise to habits, to the way of life of the animals, but that to the contrary it is the habits, the way of life and all the influential circumstances that have with time established the form of the bodies and the parts of the animals. With new forms, new faculties have been acquired, and little by little, Nature has arrived at the state where we see her now. (Trans. Burkhardt)

Of human evolution, Lamarck writes circumspectly (*Philosophie Zoologique* 1.349):

> If man were distinguished from the animals only by his organization, it would be easy to show that the characters of organization that one uses to form a unique family for man with his varieties are all the product of old changes in his actions and habits that he has taken up, and which have become peculiar to his species. (Trans. Burkhardt)

The similarity to Lucretius' scheme is clear: his early humans first change their behaviour and are then changed physiologically by their new environment. Lamarck's theory was of course, different from that of Lucretius in that Lamarck explained the origins of species in a similar way to Darwin, with life evolving from simpler to more complex creatures. Lucretius' evolutionary adaptation on the other hand takes place within strict species boundaries ensured by the atomic laws of nature (*foedera naturae*). Empedocles also uses the inheritance of acquired characters in his explanation of the form of the backbone: the backbone acquired its flexible jointed nature from being broken while the creature was in the womb, and so from this single event each vertebrate creature has inherited a flexible backbone.[39] This example shows that Empedocles may also have used the inheritance of acquired characters to explain human evolution.

Lamarck's system does not rely upon extinctions of less well-adapted forms as Darwin's does, although adaptive mutations may well thrive at the expense of others.[40] In Darwin's theory, extinctions of non-adaptive mutations are necessary to ensure the passing on of the genes of adaptive forms. Natural selection must work as a filter, removing non-adaptive mutations.[41] Indeed the association of adaptation by extinctions with evolution that we tend to make nowadays is a Darwinian innovation. Lamarck's great rival in zoology, Baron Cuvier,[42] was a creationist and species fixist who first proved scientifically that species extinctions have

happened in the past, arguing that if creatures were able to evolve and adapt themselves in the face of environmental change we should see no species extinctions in the fossil record. This shows that extinctions were a feature of creationist theories before Darwin. Darwin's achievement was to unite extinctions with Lamarck's evolutionary theory and so devise a plausible mechanism of natural selection.[43] This is why we tend to associate, quite wrongly, any theory of adaptation that relies on extinctions with evolution. Before Darwin, the preconception was quite the opposite. As an illustration of pre-Lamarckian and pre-Darwinian thinking, we can see both of Lucretius' forms of adaptation – extinction of maladapted forms, and a direct evolutionary response to environment with the inheritance of acquired characters – in Rousseau's *Second Discourse*, part 1:

> Accustomed from their infancy to the inclemencies of the weather and the rigour of the seasons, inured to fatigue, and forced, naked and unarmed, to defend themselves and their prey from other ferocious animals, or to escape them by flight, men would acquire a robust and almost unalterable constitution. The children, bringing with them into the world the excellent constitution of their parents, and fortifying it by the very exercises which first produced it, would thus acquire all the vigour of which the human frame is capable. Nature in this case treats them exactly as Sparta treated the children of her citizens: those who come well-formed into the world she renders strong and robust, and all the rest she destroys.

Again, as with Lucretius, Rousseau presents his early humans evolving in response to their environment, but since he was a creationist and species fixist, in a context of species stability.

This, then, in outline, represents something of the scientific background against which Plato's *Timaeus* should be viewed. It is clear that considerable achievements had been made in zoogony and theories of the origin of species in the fifth century BC, and it seems that a pattern of anti-teleological mechanistic thought can be traced from the extant fragments of the Presocratics and from their successors involving the origins of life by spontaneous generation from a mixture of heated earth and water, random construction of animals, adaptation by extinction of maladapted forms, the close original relationship between humans and animals, and the differentiation of modern humans from an original beast-like state in an evolutionary process that stops short of crossing species boundaries caused by the effects of culture and technology.[44] It does not seem that there was any clear idea that humans had evolved from animals, and, although evolutionary mutation was known and accepted, it was not used to explain the origin of species *per se*. At the same time humans were clearly seen as a species of animal with particular characters, some inborn

and some acquired, that made them distinctively human.[45] This remained substantially the rationalist position until the advent of Lamarck's theories in the early nineteenth century.

V. Zoogony and evolution in Plato's *Timaeus*

The above theories derive from Presocratic philosophical cosmogony; they were not of course conceived in a vacuum, but entered a field already well treated in myth. Greek anthropogonic myths shared some of the central features of Presocratic theories, especially the ideas of human origins from the earth[46] and the formation of life from earth and water.[47] A detailed study of the relationship between myth and Presocratic cosmology is beyond the scope of this paper, but Plato in the *Timaeus* makes much use of mythological accounts, and exploits the often blurred boundaries and close relationship between them and scientific cosmology. The following examination therefore of the mechanism of the origin of species in the *Timaeus* must also be seen in the context of cosmological myth.

A.E. Taylor was firmly against examining the scheme of the origin of species in the *Timaeus* in its scientific context, saying in his commentary (1928, 635):

> At any rate it is wholly wrong to suppose that Plato is in deadly earnest, and to raise the question whether there really is an 'ontological significance' in difference of sex or whether anything could really be made of a doctrine of evolution *au rebours*.

However, since Plato does invite a mechanistic analysis of the origin of species from the reader, especially from one, ancient or modern, familiar with the standard Presocratic approach, I feel I should take him at least as seriously as I do Lucretius and Empedocles. Accordingly, it seems to me perfectly reasonable to examine the differences between views expressed in the *Timaeus* and traditional zoogonies, especially since some of the features it contains would, almost inevitably, strike ancient readers as startlingly unusual in a scientific account.

The zoogony presented in the *Timaeus* can be seen to share some features of Presocratic theories but is different in four key areas, suggesting that Plato appropriates Presocratic physical ideas, especially those of Empedocles and Democritus, and then subverts them.[48] Firstly, the order of creation in the *Timaeus* is unusual with humans created first, before the animals; secondly, animal species are formed by an inter-species evolutionary process of mutation from one to another; thirdly, there are no extinctions, such as we find in Empedocles and Lucretius, and fourthly, we have no spontaneous generation of life from the earth, as in Lucretius, Empedocles, and the other Presocratic zoogonies.

The Presocratics, including the atomists, make little distinction between anthropogony and zoogony, and indeed zoogony is simply a function of cosmogony, and anthropogony is an aspect of zoogony.[49] In the *Timaeus*, however, we see a strong distinction between humans and animals, and the position is reversed, with the origin of animal species as a function of the origin of humans. Plato's inversion of the traditional human/animal relationship gives a relationship between humans and animals which fits an anthropocentric view of the hierarchy of nature more closely than the Presocratic theories, where humans and animals arise from the same source, either at the same time or with animals first.

However, the cosmogony, zoogony, and anthropogony of the *Timaeus* start normally enough, with the creation of the world, followed by the creation of the stars, and then of life, in the traditional order exemplified by Lucretius at 5.416–836.[50] Living creatures are created by a demiurge (who makes the souls, *Timaeus* 41d) and the lesser gods (who make the bodies and fasten them to the souls, 42e–43a). The materials used for the bodies are also the traditional ones, matching the Empedoclean elements of earth, air, fire, and water. The resulting creatures are to become the three mortal kinds as yet uncreated (41b8 with 39e–40a). The four forms of living creatures are the stars, birds, water animals, and land animals. Here we find the first inversion, with the astronomy treated as part of the zoogony, rather than, as we should expect from the Presocratics, as part of the cosmogony. Then there is a seemingly traditional picture of the place of humans in the grouping 'land animals', but followed by the statement that the original state of all these creatures is to be human (42a1). Thus, the order of creation is reversed, with humans created first and then animal species.[51] Animal species are formed by a process of degradation from the original ideal creature, the human being (42b ff., 91a ff.) so that animals are human, an inversion of the Presocratic scheme in which humans are animals. The variety of nature, accounted for by Lucretius by the random creation of patternless creatures in the beginning, is thus derived by an evolutionary process from an original singularity of form. Humans who are unable to control the emotions engendered by the tension between body and soul (42a ff.) mutate in the second generation and become women. We are not told of the origins of males, but we may presume that the original humans are not gendered.[52] Here again we find an unexpected separation when compared to the Presocratics and Lucretius, who describe humans arising as already gendered creatures.

This process of mutation and 'decline' continues until the earth is populated by all the animal species (91d ff.) that are necessary to ensure that it matches the original world of which this world is only a copy. This

makes it clear that we are still in a traditional context of the immutability of species. The animals can mutate one into another, but the pattern for each species is already fixed. No new species that does not already exist in the original world can be created by this process. In the *Timaeus*, we have no extinctions of maladapted forms as in Empedocles, Lucretius 5.837–54, and Darwin. The mutations are caused by a behavioural change, which leads to physical change: bestial behaviour leads to a metamorphosis into a creature with that particular form of bestial nature (42c). Thus this process is Lamarckian in the sense that function precedes form, if somewhat oddly in the Platonic context. The functionalist scheme of evolution is essentially the same as that found in Lucretius 5.1011–27 where modern humans evolve physically in response to behavioural change. Yet the Timaean scheme is the reverse of those of both Lucretius and Lamarck. Lamarck envisaged an inevitable rise of simpler creatures towards more complex forms on a sort of evolutionary escalator, with the simplest creatures of all being constantly spontaneously generated to fill the gaps left by those who had evolved and moved 'up', while Plato gives a descent from the most to the least complex. Lucretius, as is traditional, has a move away from a bestial state towards a fully human one, while Plato's humans evolve towards the bestial.

The three animal groupings described correspond to three of the four Timaean constituents of matter, which have long been recognized as perversions of the Empedoclean 'roots':[53] birds correspond to air, land animals to earth, and fish to water. The fourth 'root', fire, corresponds to the fourth of the kinds of living creatures, the stars, whose birth is described at 39e ff. We are therefore again reminded of Presocratic cosmology. Birds are formed by a process of attraction of like to like (91d7 ff.): 'light-minded men' grow feathers instead of hair and become birds, i.e. animals who inhabit air, the light element. We find the formation of the world described by such a process of attraction of like to like in Lucretius' cosmogony (5.449 ff.), where the elements separate out as the world forms, earth sinking down to the bottom because of its weight, water next heaviest forming the sea, air floating above earth and sea, and aether, lightest of all, rising up to form the stars.[54] Diodorus Siculus 1.7.1–6 gives a picture of the origins of the animal kingdoms by the same process: earthy creatures become land animals, wetter creatures become fish and airy creatures become birds. This viewing of zoogony and cosmogony in the *Timaeus* as part of the same process is very much what we should expect from Presocratic sources,[55] but Plato plays with this mechanistic idea and subverts it, bringing in the idea of metamorphosis caused by behaviour. We may reasonably assume that 'light-minded men'

refers, in a mischievous way, to the Presocratic physicists, since we are told that they are 'meteorologists' who rely on their eyes to provide the strongest proofs of their theories.[56]

Land animals are said to have been formed from men who did not study philosophy or cosmology at all, in a process of attraction of like to like similar to that affecting the birds: they are drawn downwards to the earth because of their kinship with it (91e8 ff.). In addition, we are given a further factor in their metamorphosis: the atrophy of the rational faculties in the head from disuse leads to a distortion and elongation of the head, making it more beast-like. This again reminds us of two important factors in Lamarckian evolution: the atrophy and loss of organs from lack of use, and the inheritance of acquired characters.[57] As the neck of the giraffe has been distorted by stretching in constant use, so organs and limbs may weaken from lack of use and eventually disappear. A straightforward teleological explanation is also added to these two aspects. At 92a1 ff., we are told that god granted four legs to these animals in order that they might be dragged down to the ground further still. The most foolish land animals were granted no limbs at all and became snakes, and so the process of attraction of earth to earth was completed.

Fish and other sea creatures were formed by two processes (92a8 ff.). They, being unworthy to breathe pure air because of their wickedness, were relegated to the sea to breathe the more turgid water. They also were given the lowest geographical position possible on earth to match their lowest position of intelligence.[58] This again seems a mixture of the teleological and mechanistic. We could reasonably expect that fish, as with land animals, would be formed by the further atrophying of their rational faculties through lack of use, leading to a further flattening and lengthening of their bodies and loss of limbs. But we are told that they were remoulded by the gods in a purposive way to match their wicked natures. Of course, the metamorphosis of creatures into new species is teleological whether or not the process is mechanistic and functionalist, since all species come into being to fulfil the purpose of the demiurge and so complete the perfect match of this world with the original. The derivation of fish from land animals may reasonably be seen as evidence that Plato is inverting Anaximander's theory that all life, including land animals, arose in water (see above, Section III). Lucretius specifically argues against the idea that land animals could have originated in water (5.794), and this is often interpreted as a polemic against Anaximander.[59] All theories of the spontaneous generation of life are vulnerable on this point of accounting for both land and sea-creatures because of the insistence on the fixity of species, as can be seen from Lucretius' avoidance of the subject

of the generation of fish and Anaximander's expedient of protecting the first humans inside fish-like creatures. Accordingly, Plato is given an easy target, and his evolutionary theory of land animals turning into sea-creatures is a more coherent explanation. From a Darwinian point of view, it would be even more acceptable had he not inverted Anaximander's theory and instead derived land animals from sea-creatures.[60] However, in Plato's inverse and strictly hierarchical chain of being, this would mean that fish are 'higher' in the scale than land animals, an unacceptable conclusion. Diodorus Siculus, who gives a standard picture of the spontaneous generation of life from the earth (1.7), with the watery creatures becoming marine life, may have solved the problem of fish survival: since some parts of the world were wetter than others, we could perhaps imagine the generation of fish in mud or shallow pools.

In the Timaean scheme we find both the traditional species stability and an evolutionary origin of species by transformation from one to another, resulting in a theory of evolution within a fixed system of species similar in some ways to that found in Lucretius 5.1011–27 (discussed in section IV). However, Plato approaches the problem quite differently from Lucretius. Lucretius has all species, including humans, arising fully formed by spontaneous generation, but then the humans, at first physically and psychologically beast-like, undergo an evolutionary change that stops short of crossing species boundaries. These boundaries are provided by the passing from parent to offspring of a fixed atomic genetic pattern that ensures the continued integrity of the species.[61] Plato's species boundaries are also fixed, but they arise from the patterns of the animals that the demiurge has already created. Thus, the animal species in this world exist both potentially and by necessity: they must come into existence to ensure the perfect match of this world to the demiurge's model (41b8–c1).[62] It should thus be impossible for any species to come into existence that does not already exist in the creation of the demiurge, and no species extinctions are allowable for the same reason. Accordingly, we should expect the period of metamorphosis of animals one into another to be limited strictly to the period before all species have come into existence. After this, no new forms can be created, and it would seem unnecessary for there to be continued physical change when the process of decline and rise through the hierarchy can be achieved by metempsychosis. The description of the continued metamorphosis of animals 'both then and now' (92b9–c2) seems to be a conflation of the two ideas of metamorphosis and metempsychosis of the kind often found in mythology, especially in Ovid's *Metamorphoses*.

VI. Metamorphosis and metempsychosis

The scheme of origin of species given in Plato's *Timaeus* may well be unparalleled in scientific philosophy, but it is of course familiar from Greek mythology. The *Metamorphoses* of Ovid is a rich source of aetiological transformation myths, in which the origin of a particular species of animal is explained as a process of transformation undergone by a human being.[63] The aetiologies are clearly intended to account for a particular characteristic of the species, behavioural or physiological, by the presence of that characteristic in the human and its retention in the new species. Further, certain humans become animal species because of the possession of a particular characteristic. In this, the thinking would seem to be very similar to the Platonic assumptions in the *Timaeus*, of a behavioural causation of physiological mutation, much in the Lamarckian manner. People start behaving in a certain way and then become a creature that matches their behaviour. The theory is clearly circular in Ovid: bestial behaviour leads to transformation into bestial shape, but the beast did not exist before to provide a pattern of shape or behaviour. The *Timaeus* avoids this circularity by having all species, and so a pattern of bestiality, already existing in the demiurge's model. The origins of birds, Plato's first example of an origin of species by transformation (91d7 ff.), are known to have been explained by such processes of metamorphosis by Boios in his *Ornithogonia*,[64] one of Ovid's sources among others, and so the theory was well known and comfortably accepted in mythography. The status of these schemes of origin of species as Pythagorean is doubtful. On the one hand Plato's and Ovid's accounts of species origins have a strong Pythagorean colouring,[65] but on the other we are told by Porphyry that Pythagoras held a very standard materialist view of cosmogony (*Life of Pythagoras* 44):[66]

> ...when the first origin and birth of all things was in confusion, and many things were at the same time mingled together, sown together, and rolled together in the earth, birth and separation gradually took place, animals being born and plants growing up at the same time. Then from the same putrefaction men were born and beans sprouted.

This theory of the origins of life by the spontaneous generation of fully formed species is very much what we would expect of a materialist physicist, and would seem to have no place in it for the origin of species by evolutionary metamorphosis as we find in the *Timaeus*. In Plato's Pythagorean account all creatures are formed by a process of metamorphosis, and it would seem that the two processes of metamorphosis and spontaneous generation are mutually exclusive in a scale of descending

evolution.[67] But the reconstruction of Pythagorean physics is highly speculative, given the paucity of independent sources and the influence of the *Timaeus* on later commentators,[68] and the question of whether the Pythagoreans had such a scheme of the origin of species by transformation, or whether Plato has grafted a mythological scheme onto Pythagoreanism, is an open one. Empedocles has always been closely associated with Pythagoreanism (see Wright, 1995, 4 and 275, Furley, 1987, 79). This seems partly based on evidence for his vegetarianism (fr. 139), belief in transmigration (fr. 117) and praise of Pythagoras (fr. 129), and partly upon an association of the four-element theory with Pythagoreanism. It is possible, however, that the Pythagoreans did not have a four-element theory and that the confusion arises from the *Timaeus* itself (so Burkert, 1972, 69–71 and 356), according to Aristotle *Met.* 990a16:

> They have not said anything at all about fire or earth or the other material things of this sort, because, I suppose, they did not have anything distinctive to say about perceptible things.

However, it can now be seen from the Strasbourg fragments that Empedocles' religion and physics are not mutually exclusive (reinforcing Wright 1995, 57–69). The proem to the *Physics* may have contained the Pythagorean material formerly attributed to Empedocles' other poem the Καθαρμοί (*Purifications*), in particular the praise of Pythagoras for recalling his past transmigrations (fr. 129), an explanation of transmigration (fr. 115), and the entailed horror of meat eating, exemplified by a father sacrificing his transmigrated son as an ox (fr. 137).[69] This gives a much stronger link between the physics and the daemonology, but there is no sign of Empedocles accounting for the origin of species by blending transmigration with physical mutation as Plato does.

It may well be that we see Plato in the *Timaeus* adopting a similar technique to that of Vergil, who remythologizes the cosmology and aetiology that Lucretius had previously appropriated and demythologized. Plato remythologizes cosmology previously appropriated from myth by the Presocratics.[70] Ovid in the *Metamorphoses* achieves the same end by the use of scientific terminology applied to mythological cosmology and aetiology.[71] Empedocles' presentation of physics in a Pythagorean context would make Plato's task easier since, with divisions between religion and physics already eroded, Plato can make the last move towards producing the blend of mythology and physics we find in the *Timaeus*. According to this analysis, Plato would be appropriating certain features of Presocratic physics and Pythagorean psychology, available to him ready blended in Empedocles' *Physics*; he then further blends them with mythological

transformational aetiologies for the pattern of species to produce an inversion of scientific zoogony, which reclaims zoogony for the teleological view of the universe and has a gloss of scientific respectability. In this he would be greatly aided by Empedocles' close association with Pythagoreanism, and especially with the theory of metempsychosis. The transition from metempsychosis, the migration of souls between creatures in an 'upward' or 'downward' progression, to the idea of the physical formation of species by transformation of one into another is not too great a conceptual leap, and seems almost inevitable.[72] The relationship between metempsychosis and metamorphosis is left ambiguous by both Plato and Ovid. In *Metamorphoses* 15.60–478, Ovid's Pythagoras never quite says that the aetiologies of species' origin by metamorphosis presented earlier in the poem are strictly analogous to the transmigration of souls, but strongly suggests this.[73] Plato similarly leaves the exact relationship between the origin of species by evolutionary metamorphosis and Pythagorean metempsychosis vague, especially at *Timaeus* 42b3–d3, 90e8–91a1, 91d7–8, 92b9–c2.

VII. Conclusion: Plato's *Timaeus* as subversive text

We can therefore see that Plato has taken scientific cosmogony and zoogony and subverted it for his own teleological purposes. The bodies of living creatures are formed from Presocratic ingredients, but they are not generated spontaneously from the earth. The four types of living creatures are analogous to the four Empedoclean 'roots' of matter. Species are at one and the same time fixed *and* able to metamorphose into one another. The origin of species is achieved by an evolutionary process, without extinctions. The order of creation and the relationship between humans and animals is inverted to produce a more anthropocentric cosmology. A scientific gloss is given to a fundamentally mythological zoogony by the appropriation of scientific themes and language, and, finally, the introduction of Pythagorean metempsychosis returns us, via Empedocles, to links with mythological cosmogonies in Presocratic science. The whole is achieved with a thoroughly comprehensive grasp of scientific cosmology.

To bring my argument back to where I began, I hope I have shown in this partial and selective study that it is worthwhile attempting to examine the *Timaeus* in a mechanistic context, that we inevitably view ancient theories of evolution from a Darwinian perspective, and that recognition of that fact can yield a clearer view of antiquity. To put it another, Fowlerian, way: from Darwin to Plato's *Timaeus*, Lucretius, and Empedocles, the directionality of intertextual reference is reversed.

Whether we like it or not, Darwin will be our source text and *Timaeus*, Lucretius and Empedocles our target texts, and so knowledge of Darwinism becomes crucial.[74]

Finally, just as Plato's *Timaeus* appropriates and subverts a tradition of Presocratic scientific cosmology, it is itself part of a subversive tradition. This finds modern expression especially in 'Scientific Creationism', which seeks to undermine Darwinism by the appropriation of its very scientific basis.[75] As part of this tradition, atomism in particular has been the subject of many accusations over the centuries that it cannot account for the stability of the universe or the ontological stability of creatures. A history of these attacks must wait for another day, but in the meantime, my favourite subversion of atomistic cosmology is in Flann O'Brien's *The Third Policeman*. O'Brien brilliantly plays on the idea of the 'law' of nature. In the parallel universe of 'The Parish', it is necessary for three policemen to control and set limits to the damaging effects of the workings of the atomic theory by the use of complicated and mysterious machinery. However, as people ride their bicycles, the atoms of human and bicycle become exchanged, and so Sergeant Pluck also takes more direct action to limit the damage done to people's atomic integrity by stealing their bicycles on a regular basis and then 'finding' them again after a few days. This theft slows down the metamorphosis into bicycles, but of course, there are similar dangers involved in walking and horse riding.[76] *The Third Policeman* 1967, 72 ff.:

> 'The Atomic Theory' I sallied 'is a thing that is not very clear to me at all.'
> 'Michael Gilhaney' said the Sergeant 'is an example of a man that is nearly banjanxed from the principle of the Atomic Theory. Would it astonish you to hear that he is nearly half a bicycle?'...
> 'Are you certain about the humanity of the bicycle?' I inquired of him. 'Is the Atomic Theory as dangerous as you say?'
> 'It is between two and three times as dangerous as it might be' he replied gloomily. 'Early in the morning I often think it is four times, and what is more, if you lived here for a few days and gave full play to your observation and inspection, you would know how certain the sureness of certainty is.'...
> 'The gross and net result of it is that people who spend most of their natural lives riding iron bicycles over the rocky road-steads of this parish get their personalities mixed up with the personalities of their bicycle as a result of the interchanging of the atoms of each of them and you would be surprised at the number of people in these parts who are nearly half people and half bicycles.'...
> The Sergeant's face clouded and he spat thoughtfully three yards ahead of him on the road. 'I will tell you a secret' he said very confidentially in a low voice. 'My great-grandfather was eighty-three when he died. For a year before his death he was a horse!'
> 'A horse?'

> 'A horse in everything but extraneous externalities. He would spend the day grazing in a field or eating hay in a stall'...
> 'I suppose your great-grandfather got himself into this condition by too much horse riding?'
> 'That was the size of it. His old horse Dan was in the contrary way and gave so much trouble, coming into the house at night and interfering with young girls during the day and committing indictable offences, that they had to shoot him...but if you ask me it was my great-grandfather they shot and it is the horse that is buried up in Cloncoonla churchyard.'

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Notes

[1] For the relationship between Plato's *Timaeus*, the book of Genesis and Lucretius, see Pelikan, 1997.

[2] On the reversal of the directionality of intertextual reference see Fowler 2000, 115–35. On Lucretius and Plato see de Lacy 1983, Solmsen 1951, Sedley 1998, 62–9, Cole 1990.

[3] Lucretius was the main focus for creationist attacks until Darwin's *Origin of Species* took over the role of chief exponent of an anti-teleological view of creation. See Townsend 1889, part 6, 'The Revolution Against Evolution' <http://www.rae.org/> with the comments of D. Sharp ad loc. in *Origins & Design* 18:1 <http://www.arn.org/docs/odesign/od181/editor181.htm>. See also Karen Bartelt on Lucretius' place in the anti-Evolutionist exhibition at the Institute for Creation Research, 'A Visit to the Institute for Creation Research' <http://www.utm.edu/research/iep/e/evolutio.htm (all November 1999), and Jones, 1989. Like the Presocratics and Atomists Darwin is principally concerned with the mechanism of adaptation, but his lack of knowledge of ancient ideas is shown by the 'Historical Sketch' prefacing *Origin of Species* (6th edn, 1872, xviii–xix) where he wrongly attributes an evolutionary theory to Aristotle on the strength of *Physics* 2.8 198b. It is indicative of the extent to which we view ancient theories through a Darwinian filter that Edelstein felt called upon to set the record straight. He rightly shows that Aristotle was not an evolutionist (see Edelstein, 1943/4, and Blundell, 1986, 62 ff.). I spare the reader my discussion

of this Darwinian dominance of our thinking in terms of Dawkins' 'memes', but meantime see Dennett 1995, 342–69.

[4] This may be an unduly polarized view, but Furley 1989, 225, speaks of a 'crisis' in cosmology, and identifies 'just two fundamentally and comprehensively different ways of interpreting the cosmos. On the one hand, the atomic theory of Leucippus and Democritus, later adopted by Epicurus and his followers; on the other the theory of Plato, later adopted and modified by Aristotle, and again modified by the Stoics.' I suggest that the atomic theory is not a crucial prerequisite for an anti-teleological mechanistic view of creation, and that Empedocles, at least, of the other non-atomist Presocratics is also an anti-teleologist.

[5] It is important to point out that Lucretius is describing the creation of this world rather than the entire universe. For the Epicureans the universe is infinite in time and space, while this world (including sun, stars, moon and planets) is mortal and will one day perish (see Solmsen, 1953). The Epicurean universe is made up of an infinite number of worlds constantly coming into being and dying, see Epicurus *Ep. Hdt.* 45, and 73, *Ep. Pyth.* 88, Lucretius 2.1048–89, and 5.91 ff.

[6] For the Epicurean idea of limit as the 'law' that ensures the regularity of the universe see Blundell, 1986, 92–3, and Long, 1977, 63–88. The key texts are Epicurus *Ep. Hdt.* 42–3, Lucretius 2.478–531, 661–79, 5.440–2 and 923–4. The need for 'law' to prevent the atomic theory causing cosmic chaos is brilliantly satirised by Flann O'Brien in *The Third Policeman*, in which three policemen are needed to control and restrict the workings of the atomic theory; see section VII.

[7] Furley, 1989, 229 ff. points out the traditional nature of the analogy drawn between cosmogony, zoogony and embryology, in which the three are viewed as essentially similar processes of birth. For Lucretius' zoogony in general see especially Schrijvers 1999.

[8] 5.836–7 reads *multaque tum tellus etiam portenta creare | conatast*... I take *tum* as 'at that time' rather than 'next' in a sequence of creation (see West, 1964 on *tum* at 5.805). Schrijvers 1996, 842–3, interprets the line as 'the earth also produced monsters (as women sometimes do now)'. Professor Stephen Simpson has suggested to me that perhaps this production of monsters by the earth is due to her increasing senescence. I feel however that this would require there to be a pre-existing pattern for a norm of species, in the Platonic manner, which the earth was no longer able to follow due to old age, and I cannot think that this is an Epicurean view.

[9] See esp. the commentary of Pease ad loc. for details of ancient providentialism.

[10] Lucretius uses *saecla* interchangeably with, and as the plural of, *genus*: 5.862 *genus acre leonum saevaque saecla*, 5.431 *generisque animantum*, 5.925 *genus humanum*, 5.988 *mortalia saecla* (of humans), 5.982 *saecla ferarum*. Aristotle uses *eidos* for species, *PA* 644a24–5, and *genos* for genus, *PA* 644a33. But see Pellegrin 1982 and 1985, who points out that Aristotle is not particularly

concerned with establishing an accurate system of taxonomy, and this would seem to be true also for Lucretius.

[11] Survival by cooperation is crucial to the Epicurean view of the evolution of society, see Lucretius 5.1011–27 (Section IV), with Algra 1997, 141–50, and Blickman, 1989, 157 ff.

[12] I am here deliberately anticipating Aristotle's discussion of Empedocles' theory in *Physics* 2.8 198b. It seems that the Epicurean theory would ascribe the 'norms' of nature such as four limbs and five digits entirely to chance, and that these 'norms' need not necessarily obtain in other worlds where conditions may be different, see *Ep. Hdt.* 74, *Ep. Pyth.* 88.

[13] 5.923–4: *sed res quaeque suo ritu procedit et omnes | foedere naturae certo discrimina servant* ('but each thing proceeds after its own fashion and all things preserve their distinctions by a fixed law of nature'). See 2.700 ff., Blundell 1986, 92–3, Schrijvers 1974, 249 ff., O'Brien 1968, 311 ff., and note 7 above.

[14] The fixity of species was an accepted fact in nearly all ancient scientific thinking on zoogony, see Furley 1987, 98. Interestingly, the traditional Darwinian insistence on the constant mutation of species under the influence of environmental change has recently come under question. Palaeontologists such as Gould and Eldredge put forward a theory of 'punctuated equilibrium' in which species stay much the same for millions of years and will not evolve except under special conditions. When faced with environmental change they will first move location ('habitat tracking'), secondly they will become extinct, and only thirdly will they evolve to adapt themselves to a new environment (see especially Eldredge 1995, 57 ff.). At the extreme end of the Darwinist spectrum is the 'Red Queen' hypothesis of van Valen 1974, in which species will constantly evolve even without environmental change, in an attempt to retain their relative positions in a competitive hierarchy.

[15] Empedocles fr. 17 with new Strasbourg fr. a(ii) in Martin and Primavesi 1999. The Empedocles fragment numbers are those of DK 1952. Although Martin and Primavesi (88 ff.) consider that the new fragments of Empedocles show conclusively that he has this double cosmic cycle, others are still unconvinced. For the different ancient interpretations see Wright, 1995, 49 ff., and for various modern interpretations see O'Brien, 1969, 196–236, Osborne, 1987.

[16] See Martin and Primavesi, 1999, 138–9 (commentary on p. 226–46). They consider that this passage introduces the zoogony under Strife; however, the phrase 'coming together and unfolding of the stock' a(ii) 23 and 30 suggests that both zoogonies are here introduced, and 'as many as are now remaining of this generation' a(ii) 25 suggests the role of extinctions, which are certainly involved in the zoogony under Love but may or may not be part of the zoogony under Strife. Accordingly, I have placed a(ii) 23–30 as an introduction to the zoogony under Love.

[17] i.e. male and female, a phrase borrowed by Lucretius, compare 2.1081–2: *sic montivagum genus esse ferarum | sic hominum geminam prolem*, 'thus is the mountain-roaming race of wild beasts, thus the twin stock of humans'. See Martin and Primavesi ad loc.

[18] Compare Aristotle *PA* 661b7 and Xenophon *Mem.* 1.4 where the configuration of the teeth is presented as evidence of design in nature.

[19] See Furley 1987, 94–8, 1989, 115–20, and Sorabji 1980, 180 ff. There are some striking intertextualities between Lucretius' *portenta* and Empedocles' monsters; cf. 5.839 *androgynem* and Empedocles fr. 61.3–4 μεμιγμένα τῇ μὲν ἀπ' ἀνδρῶν | τῇ δὲ γυναικοφυή..., 5.842 *vinctaque membrorum per totum corpus adhaesu* and fr. 60 ἀκριτόχειρα 'with hands not properly articulated or distinguishable' Wright, 1995, ad loc. (so also Bollack, 1969, vol. 3.2, 421).

[20] Sorabji 1980, 180–1, concludes that Empedocles presents a non-teleological theory. Sedley 1998, 18–21, and Long and Sedley 1987, 2, 64 consider that Empedocles' scheme is not necessarily anti-teleological and that Aristotle chooses it simply to illustrate what an anti-teleological theory would look like if there were one. Against this, see my review of Sedley, Campbell 1999. Aristotle's criticisms are in the context of his proof of biological teleology as a final cause.

[21] See Dean-Jones 1994, 162 ff.; Sorabji 1980, 176–7; Wright 1995, 10 and 49–52.; Gotthelf 1987, 215–6 (in Gotthelf and Lennox 1987). Aristotle *GA* 722b17–30 describes Empedocles' theory as pangenetic and preformationist, with the preformed miniature limbs of the embryo provided separately by each of the parents' organs (see Balme ad loc.). The Hippocratic theory is also pangenetic but less preformationist, e.g. *Nat. Puer.* 17 (vii 496.19–20). Lucretius is also a pangeneticist, but his theory avoids the necessity for preformation of tiny limbs and organs by having each species pass on to its offspring an immutable atomic pattern, which presumably contains all the information necessary for guiding the formation of the embryo (2.700 ff.), see Balme on *GA* 722b3 ff. The ancient debate on embryology was mirrored in the eighteenth century in the arguments between the Preformationists and the Epigeneticists. The Preformationists considered that each embryo must begin as a tiny homunculus within the egg or the sperm since, as mechanists, they denied the possibility of an overarching 'vitalistic' force to organize separated parts of an embryo into the correct configuration. The Epigeneticists argued that the material for the embryo must be supplied by both parents if inheritance of characteristics from either parent were to be accounted for. The Epigeneticist Pierre Louis de Maupertuis attempted to solve the difficulty from a mechanistic point of view in his *Vénus physique*, 1745, by arguing that the disaggregated parts of the embryo contained within the seed of both parents were brought together by a kind of gravitational attraction between correctly fitting parts. The similarity of this system to Empedocles' is clear: Maupertuis has simply replaced Empedocles' Love with 'gravity' as a combining power. See Gould 1985, 150.

[22] See Sedley 1998, 19–21.

[23] As an example, my 8-year-old daughter recently asked me 'Why do trees have leaves?' I replied without thinking, 'So they can make their food', an answer which satisfied her. Then I realized the explanation was teleological and tried to put it properly: 'Well, no, they can make their food because they have leaves...' After ten minutes of this she was thoroughly confused. For the evolution of the eye see Dawkins 1996 and Nillson 1989. For teleology in biology see especially

Mayr 1961, and Gould and Lewontin 1979. Mayr allows that teleological thinking may be useful in certain circumstances, Gould and Lewontin fiercely attack any form of teleology.

[24] It appears that we may trust Simplicius since he seems to have worked directly from Empedocles' text and, although he and Aristotle agree, Simplicius explains Empedocles more clearly and provides more detail. See Wright 1995, 51.

[25] Aristotle (*Physics* 198b33–99a8) rejects Empedocles' theory only because it relies upon the sort of chance that is not seen in nature, and not because it could not account for fine adaptations.

[26] However Strasbourg fr. a(ii)25 may possibly suggest extinctions of viable creatures rather than unviable ones such as the 'man-faced ox creatures': ὅσ[σ]α τε νῦν ἔτι λοιπὰ πέλει τούτοιο τ[όκοιο] 'and as many as are now still remaining of this generation'.

[27] The idea of the greater toughness, size, and strength of early humans is very common throughout ancient, medieval and modern literature, and is found in both soft and hard primitivistic contexts, e.g. *Iliad* 1.260 ff., 5.303 and 12.381–3; Hesiod *Op.* 143 ff., Herodotus 1.68; Lucretius 5.925 ff.; Vergil *Georg.* 1.63 and *Aen.* 12.899–900; Ovid *Met.* 1.414–5 and *Ars* 2.473 ff.; Pliny *NH* 6.30 and 7.15; 1 *Corinthians* 15; Aulus Gellius 3.10; Augustine *Civ. Dei* 15.9; Pseud. Clementina *Homilia* 8.10–17; Rousseau *2nd Discourse* pt. 1. Curiously, it is actually true that early-modern humans were larger and more robust than we are. The stature and robustness of Homo sapiens decreased dramatically between 10,000 and 5,000 years ago. See Lewin 1999, 60 ff. For disease resistance and natural selection see Ridley 1997, 48 ff. and Skelton 1993, 927 ff.

[28] Compare also the other reports of Anaximander in DK12 A10 and A30 (Ps. Plutarch *Strom.*, Plutarch *Symp.* 8.730e, Aëtius 5.19.4) discussed by Blundell 1986, 26–32. See also Guthrie 1957, 32 ff.

[29] That this was a problem for proponents of the original spontaneous generation of life is shown by the criticisms of the Peripatetic Critolaus (reported by Philo *Aetern. Mun.* 55 ff) who argues that if humans were originally born as adults they would still be born that way today, or if they were born from the earth as infants they would not have survived. For spontaneous generation see Waszinck 1964; Guthrie 1957, chaps. 1 and 2; Louis 1968; Schrijvers 1974.

[30] See Loenen 1954.

[31] Blundell 1986, 48, 'no other basic hypothesis, so far as we know, was ever put forward in scientific philosophy'. A similar outline of cosmogony is found in Lucretius' contemporary Diodorus Siculus 1.7. He has life originating by a process of fermentation, from wet clay heated by the sun, inside membranes that protect the embryos until it is time for them to be born. The separation into fish, birds and land animals is achieved by an attraction of like to like: wetter animals become fish, earthier ones land animals, and warmer ones birds. He does not however give a mechanism of adaptation into species. The relationship between Diodorus and Lucretius is complicated, but it is probable that they each derived their cosmogonies independently from Presocratic sources. See Spoerri 1959, 1–33, and Blundell 1986, 68 n. 22 for a bibliography of the

controversy.

[32] from Hippolytus *RH* 1.9.1 (DK60 A4.5–6).

[33] See Blundell 1986, 74 ff., Lovejoy 1936, chs. 1 and 2, and Dubois 1982.

[34] See Lovejoy and Boas 1935, 9–11 and Gatz 1967.

[35] Or 'saw the children which were created from them'; both readings must be from the male point of view: either that the men had simply not been in contact with their children before in the wandering phase, or, as I prefer, in the manner of the Trobriand Islanders, they did not realize that children had anything to do with sex until they started living permanently with the women (see Malinowski 1932). This latter realization would perhaps be a more profound psychological shock. Marullus emends *videre* to *dividere*, 'they distinguished the children who were born from them', i.e. they could now tell which children were theirs.

[36] The effects of Venus in 5.1017 are probably both a physical weakening and a psychological softening, compare 4.1121: (of lovers) *adde quod absumunt viris pereuntque labore* 'in addition they use up their strength and perish from the effort', and Ovid *Ars* 2.473–7: *tum genus humanum solis errabat in agris | idque merae vires et rude corpus erat | ...blanda truces animos fertur mollisse voluptas* 'then the human race wandered in the lonely fields | and they were of undiluted strength and rough body | ...sweet pleasure is said to have softened their savage spirits'.

[37] 5.932 *vulgivago vitam tractabant more ferarum*, 'they lived life in the wandering manner of wild beasts'. Many ancient writers refer to the first humans living a life like wild beasts, commonly a θηριώδης βίος in Greek, cf. for example Diodorus Siculus 1.8.1, Euripides *Suppliants* 195 ff., Critias *Sisyphus TrGF* 1.43 frs. 19 and fr. 25.1.

[38] See Lamarck 1809 and 1835 with Løvtrup 1987, 39–55, Burkhardt 1995, and University of California Museum of Palaeontology <http://www.ucmp.berkeley.edu/history/lamarck.html> November 1999. Note that the inheritance of acquired characters was standardly accepted in ancient thinking, e.g. Empedocles fr. 97, Aristotle *GA* 721b18 ff, (see Balme on Aristotle *GA* 721b7 ff.), but is no longer thought to be possible. However, neo-Lamarckism long provided an alternative mechanism to Darwinian natural selection, especially in the Soviet Union under Lysenko, with disastrous results for Soviet agriculture. See Bowler in Fox Keller and Lloyd 1992, 188 ff.

[39] Aristotle *PA* 640a19–22 quoting fr. 97. There is argument over whether this was an isolated chance event, or whether Empedocles means that this is how the backbone normally is formed in each creature. The latter would not rely upon the inheritance of acquired characters; see Sorabji, 1980, 180. Aristotle *GA* 721b7 ff. rejects pangenesis with special reference to Empedocles, and he gives the inheritance of acquired characters as one of the arguments traditionally used in favour of pangenesis (*GA*. 721b18 ff.). He accepts that characters may be inherited but explains the phenomenon differently, see Balme ad loc. who compares Anaxagoras fr. 10 on pangenesis.

[40] *Zoologie philosophique*: 1.37 (Løvtrup, 1987, 47–8).

[41] *Origin of Species* (6th edn, 1872), 132: '...as new forms are produced, unless

we admit that specific forms can go on indefinitely increasing in number, many old forms must become extinct'. See Bowler loc. cit. 106 ff.

[42] Cuvier 1799, 12. See Burkhardt 1995, 128–9 and 193–4. For the relationship between Cuvier and Lamarck see Daudin 1926–7.

[43] Bowler loc. cit. 107: 'During this period, however, extinction was considered by many to be a fact opposed to evolution... Darwinism reconciled extinction and transformation by viewing the termination of lineages as merely a failure of certain poorly adapted lines to provide descendants... Extinction became a crucial part of the mechanism of evolution. For Darwin, evolutionary change by natural selection required the elimination of inferior [*sic*] varieties – the termination of their lineages.'

[44] Aristotle criticizes the Presocratics for failing to take account of any final cause in creation, *PA* 640b5 ff.: 'Now those who were first to study nature in the early days spent their time in trying to discover what the material principle or the material cause was, and what it was like: they tried to find out how the universe is formed out of it; what set the process going (Strife it might be, or Friendship, Mind or Spontaneity)...in a like manner they describe the formation of animals and plants...' See Balme ad loc.

[45] I do not mean to suggest by this that these are proto-Darwinian theories of adaptation, rather that each is a fully worked up scheme that shares some ideas with Darwin.

[46] This is a very common idea in myth. See Guthrie 1957, ch. 1, and Loraux 1993, 196–207 on autochthony,

[47] Especially in the myths of Prometheus moulding the first humans from clay. See Blundell 1986, 10–11, and Bömer on Ovid *Met.* 1.80–3.

[48] For a study of Empedoclean influences on the *Timaeus* see Hershbell 1974.

[49] Empedocles fr. 17 plus Strasbourg fr. 'a', Lucretius 5.772 ff., Anaximander DK12 A30 (Censorinus), Archelaus DK60 A4 (Hippolytus), Democritus DK68 A139 (Censorinus) = Usener Epicurus fr. 333. Censorinus attributes the same theory to both Democritus and Epicurus, see Blundell 1986, 79 ff.

[50] Sedley 1998, 152–4, considers that the order of topics in Lucretius 5 derives from book 12 of Epicurus' *On Nature* and that Epicurus follows the order in the *Timaeus* to argue against Plato point by point. I suggest that Plato in the *Timaeus* appropriates the Presocratic and Democritean order of topics the better to subvert scientific cosmology, and that Epicurus and Lucretius follow Democritus and the other Presocratics, thereby implicitly re-appropriating the order of topics for the anti-teleological mechanistic view of cosmogony. Compare the order of presentation suggested by Parmenides fr. 10, Leucippus DK67 A1, and Archelaus DK60 A4. See my review of Sedley, Campbell 1998.

[51] See Pelikan 1997, 17 ff. The traditional order of creation is found in *Genesis* 1.11 ff., (but note the inverse order in *Genesis* 2.4 ff.), Archelaus DK60 A4, Anaximander DK12 A11 and A30, Pythagoras (Porphyry *Life of Pythagoras* 44), and Ovid *Met.* 1.73 ff. Pelikan 1997, 19–20, also sees this same order of creation in Lucretius. This certainly is implied by the manner of Lucretius' presentation, but he does make it clear that humans are created at the same time as the other

animals at 5.821–5. See West 1964, 100–1 and Schrijvers 1974, 245–7.

[52] Against this see Dubois 1988, 169 ff., who takes the original Timaean humans as male. She investigates the misogynistic implications of this and other Platonic theories.

[53] See Hershbell 1974: 147 ff.

[54] For the attraction of like to like compare Empedocles frs. 37 and 62, Epicurus *Ep. Pyth.* 89, Leucippus DK67 A1 (DL 9.31).

[55] See Blundell 1986, 67 and Furley 1989, 229 ff.

[56] Compare Aristotle's criticism of the Presocratics for concentrating on the material cause and neglecting teleology in *PA* 640b5 ff. David Sedley, in conversation with me, argues that these 'light-minded men' are mathematicians rather than empiricists.

[57] The atrophying of organs due to disuse is Lamarck's 'First Law'; it is not wholly rejected by Darwin, who hedges his bets here, cf. *Origin of Species* ch. 5 'Laws of variation' and 'Effects of use and disuse'.

[58] From Lucretius' cosmogony at 5.495 ff., we should expect earth to be lowest, then sea, air, and aether. Perhaps the discrepancy may be explained by the different shape of the worlds described. Lucretius' world is the traditional atomists' flat earth, while Plato's is a sphere (see Furley, 1989, 223 ff.). In the flat earth model, earth must be below sea to support it. In the spherical model, there is no absolute up and down from the point of view of the demiurge, but from the human point of view on earth, sea will inevitably be thought of as lower than the land.

[59] See also Schrijvers 1974, 249 ff.

[60] Compare the Oparin-Haldane theory of the origin of the first life from a sort of warm chemical soup in the oceans (Skelton 1993, 847–8).

[61] I assume that the evolution undergone by humans could also apply to other animal species. Indeed it would seem necessary in any theory of adaptation to account for the vast variety of form *within* the same species. Anyone familiar with stockbreeding would know about intra-specific evolutionary change by artificial selection.

[62] The demiurge speaks only of broad animal groupings rather than individual species, i.e. birds, sea creatures, and land animals (39e1–40a), but Timaeus himself describes the creation also of snakes (92a–8), shellfish and all sea creatures (92b–7).

[63] See Myers, 1994, 27–60, at esp. 39–40: 'Ovid's primary interest in his metamorphoses...seems to have been to construct a narrative...leading naturally and often humorously to an aetiological metamorphosis that explains a prominent feature of the animal or plant into which the person is transformed. The appearance of the forms of the adjective *novus* or the word *nuper* does not always guarantee the aetiological status of the story...when Ovid tells us that Cycnus (2.377), the Pierides (5.300–1, 5.674) and Picus all become 'new' birds, it is unclear whether this newness refers to the species as a whole or to these individuals, especially since he gives us three versions of swan metamorphosis (2.367–80, 7.371–2, 12.144–5) and two hyacinth *aetia* at 10.207 and 13.396. This lack of certainty does not weaken the aetiological focus of Ovid's

metamorphoses: if the transformations are only of individuals, they nevertheless function emblematically, as the identical names suggest'.

[64] Myers 1994, 31.

[65] See Ovid *Met.* 15.60–478, with Myers 1994, 133: 'In his long disquisition, Pythagoras frequently mentions examples from the natural world that are included as metamorphoses earlier in the poem. These echoes reinforce the similarities between Pythagoras' *causae* and the mythological aetiological metamorphoses we have been considering in the rest of the *Metamorphoses*'. See also Barkan, 1986, 86 ff. For the Pythagorean status of *Timaeus*, see Burkert, 1972, 5, 64 ff., and 84 ff.

[66] The accuracy of Porphyry's report is doubtful, and this paragraph is omitted by DK58 C6, see Blundell 1986, 34–5 and Burkert 1972, 97 ff. It does seem to go against Aristotle's view (*Met.* 990a16) that the Pythagoreans had little interest in the physical nature and origins of the universe.

[67] Lamarck's ascending scale has constant spontaneous generation of the simplest creatures to replace those species lost at the bottom of the scale as creatures inevitably evolve and become more complex. In a descending scale, the problem would be why, if the simplest creatures were formed by spontaneous generation, the process of metamorphosis does not go all the way down the scale? On the other hand, if humans, the most complex creatures, were formed by spontaneous generation, then why could not the earth also create simpler creatures? Ovid manages to have both human origins by metamorphosis and animal origins by spontaneous generation (*Met.* 1.397 ff.) by giving separate origins for each.

[68] See Burkert 1972, 64 ff. and 84 ff.

[69] See Martin and Primavesi 1999, 61 ff., and Sedley 1998, 1–34. Sedley very plausibly reconstructs the proem to Empedocles' *Physics* along the lines of Lucretius' proem to book 1, but see my review, Campbell 1999.

[70] For example *Aen.* 12.921–3. and Lucretius 6.328–9; see Hardie 1986, 176 ff.

[71] For example *Met.* 1.416 ff. See Barkan 1986, 27 ff. and Myers 1994, 54–7 ff.

[72] See Barkan 1986, 86–7, and Myers 1994, 134–5. I am aware that this does not prove that it was Plato in the *Timaeus* who first made the transition from metempsychosis to metamorphosis, and that the conflation of the two may possibly be Pythagorean. In South American Amazonian cosmologies we often find accounts of the origin of particular species by the metamorphosis of a human into that species, and humans even in the present day are thought to be subject to metamorphosis into animals according to their behaviour, while at the same time animal spirits may be reborn in humans even though there was a primordial bifurcation between humans and animals. In short, the ontological stability of humans may be undermined by both metamorphosis and metempsychosis. See Griffiths 1998 and Viveiros de Castro, 1998.

[73] For example at 15.160 ff.; see Myers 1994, 133.

[74] See especially Fowler 2000, 138–55. This is true also of the relationship

between Darwin and Lamarck, who is frequently viewed through Darwin-tinted spectacles. The anti-Darwinian vehemence of Løvtrup 1987 arises from an attempt to redress the balance. Burkhardt 1995 gives a more balanced account of Lamarck's significance in the history of evolutionary thinking.

[75] Modern Creationism is extraordinarily prevalent, especially in the United States. The Internet is full of Creationist web sites, some saner than others; see especially Seth Kroger's 'Creationist Web Links' <http://www.slonet.org/~skroger/evolution/c-pages.html> November 1999. For the other side of the argument, and very stimulating debates on Darwinism and Creationism, see the 'Talk Origins Archive' <http://www.talkorigins.org/ > November 1999.

[76] Flann O'Brien, 1967, *The Third Policeman*, London. See Hopper 1995, esp. Ch. 6, 226–69: 'O'Grady Says...' (*Boston Irish Reporter* June 1998) online at <http://omega.cc.umb.edu/~irish/june1998.htm> November 1999, who notes the links between bicycle riding and centaurs (cf. Lucretius' vehement rejection of centaurs in defence of the atomic theory's ability to account for the regularity of species 5.878 ff.), and 'The No-Bicycle Page' <http://www.hellshaw.com/flann/index.html > September 1999.

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